S T U D I A N A D B E Z P I E C Z E Ń S T W E M

Nr 10 **s. 57–93** **2025**

ISSN 2543–7321
© Instytut Bezpieczeństwa i Socjologii,
Uniwersytet Pomorski w Słupsku
Przyjęto: 30.05.2025
Zaakceptowano: 30.05.2025

Oryginalna praca badawcza

DOI: 10.34858/SNB.10.2025.004

Kazimierz Kellner
Pomeranian University in Słupsk
e-mail: kazkellner@interia.pl
ORCID: 0009-0008-9825-0775

POSSIBILITIES AND DIRECTIONS OF DEVELOPMENT OF THE MULTIMEMBER AUTOMATED CRISIS MANAGEMENT SYSTEM JASMINE

MOŻLIWOŚCI ORAZ KIERUNKI ROZWOJU WIELOŚRODOWISKOWEGO ZAUTOMATYZOWANEGO SYSTEMU ZARZĄDZANIA KRYZYSOWEGO JAŚMIN

Abstract: The subject of this article concerns the possibilities and directions of development of the Crisis Management System JASMINE (SZK JASMINE). This study presents the characteristics of the system based on key functionalities and specialist modules. It also presents integration possibilities and types of areas in which the subject system was/is used. It also shows the advantages, potential and achievements as well as recommendations for the adaptation of the subject tool in Poland in a multidimensional aspect. In addition, the article contains selected definitions related to the subject of this study as well as the characteristics of specialist terms and abbreviations. The initial assumptions for this study were the author's experience from the FENIKS operation,[1] the KRYZYS-25 exercise,[2] the Crisis Management Workshops in the

[1] Operation FENIKS was conducted by the Polish Armed Forces from 13 September 2024 to 30 April 2025. It was aimed at mitigating the effects of the flood that affected the south-western part of Poland in September 2024 and was intended to support local communities and accelerate the reconstruction of infrastructure.

[2] The exercise, KRYZYS-25, was organized by the Land Forces Academy in Wrocław. The aim of the exercise was to test the principles of cooperation between uniformed services and local government administration, the Fire Department, the Police and other entities performing crisis response tasks in Poland.

FENIKS operation[3] and a number of other projects related to crisis management in which the JASMINE SZK was used.

Zarys treści: Tematyka niniejszego artykułu dotyczy możliwości oraz kierunków rozwoju Systemu Zarządzania Kryzysowego JAŚMIN (SZK JAŚMIN). W ramach tego opracowania ukazano charakterystykę systemu w oparciu o kluczowe funkcjonalności i specjalistyczne moduły. Przedstawiono również możliwości integracyjne, a także rodzaje obszarów, w których wykorzystywano wcześniej i wykorzystuje się teraz przedmiotowy system. Ukazano również zalety, potencjał i osiągnięcia oraz rekomendacje w zakresie adaptacji przedmiotowego narzędzia w Polsce w wielu wymiarach. Ponadto artykuł zawiera wybrane definicje związane z tematyką niniejszego opracowania, a także charakterystykę specjalistycznych terminów i skrótów. Założeniami wyjściowymi do tego opracowania były doświadczenia autora zdobyte podczas operacji pk. FENIKS[4], ćwiczeń pk. KRYZYS-25[5], warsztatów z zarządzania kryzysowego w operacji FENIKS[6] oraz szeregu innych przedsięwzięć dotyczących zarządzania kryzysowego, w których wykorzystywany był SZK JAŚMIN.

Keywords: security, crisis management system, (crisis) management, crisis situation, integration.

Słowa kluczowe: bezpieczeństwo, system zarządzania kryzysowego, zarządzanie (kryzysowe), sytuacja kryzysowa, integracja.

Introduction

SZK JASMINE is a product of the Polish company TELDAT. It is a professional, complete, integrated, multi-environment, automated and coherent crisis management

[3] *Warsztaty z zarządzania kryzysowego w operacji FENIKS*, https://polska-zbrojna.pl/home/articleshow/42818?t=Warsztaty-z-zarzadzania-kryzysowego-w-operacji-FENIKS, (accessed 15.05.2025).

[4] Operation FENIKS was conducted by the Polish Armed Forces from 13 September 2024 to 30 April 2025. It was aimed at mitigating the effects of the flood that affected south-western Poland in September 2024 and was intended to support local communities and accelerate the reconstruction of infrastructure.

[5] The exercise, code-named KRYZYS-25, was organized by the Land Forces Academy in Wrocław. The purpose of this exercise was to test the principles of cooperation between uniformed services and local government, the Fire Department, the Police and other entities responsible for crisis response in Poland.

[6] See *Warsztaty z zarządzania…*, op. cit.

system which is dedicated to the structures of the national and allied (NATO[7] and EU[8]) crisis management system.[9] This tool is not a new solution, it has over a decade of history,[10] but over the years it has been systematically improved and developed with new functionalities.

In addition, the added value of the system is the fact that the creators took the trouble to expand it through the experience gained in active participation in crisis, training and other projects related to crisis management in Poland: in the Polish Armed Forces and public administration entities or universities, and thanks to such conditions they can draw constructive conclusions on an ongoing basis and therefore introduce new, often unique functionalities.

The idea of broader use of SZK JAŚMIN to support public administration, services and other entities responsible for crisis management activities in Poland gained value in the context of the floods in the south-western part of Poland in September 2024, where effective, timely and uninterrupted communication between the involved services and administration was needed, as well as a real-time illustration of the crisis situation, while this tool was used by the Polish Armed Forces.

It is worth adopting a forward-looking, far-sighted approach to the use and development possibilities of the discussed solution, first of all in the non-military dimension and accept the assumptions of L. Szot and M. Świec that "for the area of Poland, of all natural hazards caused by natural factors, the greatest threat is posed by heavy atmospheric precipitation and maximum wind speeds,"[11] which can also lead to the backflow of water in rivers and other water bodies and consequently lead to so-called secondary flooding. Moreover, according to the statistics presented in Poland, the flood should be treated "as the cause of the highest losses among the crisis situations occurring in the country."[12]

---

7 North Atlantic Treaty Organization (NATO).

8 The European Union (EU).

9 Państwowa Akademia Nauk Stosowanych w Chełmie, *Wielośrodowiskowy Zautomatyzowany System Zarządzania Kryzysowego JAŚMIN w PANS w Chełmie*, https://panschelm.edu.pl/wielosrodowiskowy-zautomatyzowany-system-zarzadzania-kryzysowego-jasmin-w-pans-w-chelmieinnowacyjny-system-na-potrzeby-laboratorium-zarzadzania-kryzysowego-dla-pans-w-chelmie/, (accessed 16.05.2025).

10 J. Wołejszo, B. Biernacik, *Możliwości wykorzystania platformy Jaśmin w systemie zarządzania transportem kolejowym*, "Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników w Krakowie" 2014, no. 2(104), pp. 390, 391.

11 L. Szot, M. Świec, *Klęski żywiołowe jako przesłanki sytuacji kryzysowych*, in: "Zeszyty Naukowe Państwowej Wyższej Szkoły Techniczno-Ekonomicznej im. ks. Bronisława Markiewicza w Jarosławiu. Współczesne Problemy Zarządzania" 2017, no. 10, p. 57.

12 R. Jękot, *Uwzględnienie kwestii związanych z ochroną przeciwpowodziową w „Krajowym planie zarządzania kryzysowego na lata 2021/2022"*, "Securo" 2024, no. 11, p. 69.

The subject matter should also be viewed through the prism of the war in Ukraine, as J. Sabak points out. The author points out the need to use the tool in the field of protection of civilians, critical infrastructure facilities or threats related to the intentional destruction by the Armed Forces of the Russian Federation of facilities that could lead to radiation incidents[13] or the destruction of dams, which could lead to the flooding of wide areas of the country.[14] Such a system could also be used to support the activities of the services involved in the operation called SAFE PODLASIE as well as to support a number of other activities of services and public administration bodies in crisis situations.[15]

It should also be noted that during crisis management it is extremely important to transfer reliable information in real time between the Crisis Management Centres of individual services and public administration at the government and local government level, as well as the services involved in the operation, such as the State Fire Service, the Police or the Health Service, which has a direct impact on the effective saving of human life, health and property.

A uniform crisis management system is necessary for the proper management of crisis response activities in all services such as state administration and other entities that can be used to carry out tasks in this scope. In Poland such a system has not been implemented to date, but the conditions described above can be fully implemented with the support of the functionalities provided by the SZK JASMINE system, which has been tested in the most dangerous crisis situation of the past year in Poland, i.e. the flood in the south-western part of Poland.[16]

The main objective of this study is to identify the current functional capabilities and determine key directions for the technological and organizational evolution of the JASMINE Multi-Environment Automated Crisis Management System (JASMINE) in the context of contemporary hybrid and military threats.

The research question of this work is: How does the technological development and multi-environment architecture of the JASMINE Multi-Environment Automated Crisis Management System (JASMINE) improve the effectiveness of crisis response and coordination between public administration services and the Polish Armed Forces?

---

[13] A radiation emergency means an unusual situation or event related to a source of ionizing radiation, requiring urgent intervention measures in order to: mitigate serious adverse effects on human health, safety, quality of life, property or the environment, or reduce the risk that could lead to serious adverse effects, Act of 29 November 2000 – Atomic Law, Dz.U. (Journal of Laws) 2024, item 1277.

[14] J. Sabak, *System JAŚMIN znajduje również zastosowanie w zarządzaniu kryzysowym i wspieraniu działań antykryzysowych*, Defence 24, https://defence24.pl/polityka-obronna/system-jasmin-tez-w-zarzadzaniu-kryzysowym-i-wsparciu-akcji-antykryzysowych, (accessed 16.05.2025).

[15] *Warsztaty z zarządzania*…, op. cit.

[16] Ibidem.

The research hypothesis assumed that: the foundation for the effective transformation of the national crisis management system is the implementation of universal multi-environment platforms such as the JASMINE Multi-Environment Automated Crisis Management System (JASMINE). Their modular expansion and automated information flow significantly shorten response times and eliminate communication inconsistencies between civilian and military structures.

The following research methods were used in this work: literature and documentation analysis: study of legal acts in the field of crisis management, doctrinal materials, official manufacturer technical specifications (TELDAT) and implementation case studies; monographic method: analysis of the historical evolution of the system and its implementation within the administrative structures and the Armed Forces; system-structural-functional analysis: assessment of the modular structure, data flow channels and mechanisms supporting the creation of a combined picture of the crisis situation; expert method: utilizing the author's experience as an expert in crisis management and consultations with system users from provincial crisis management centres and Armed Forces structures.

1. Definitions of basic terms in the field of crisis management and the JASMINE crisis management system

To better understand the subject matter of this article and the specifics of how the JASMINE CMS operates, it is worth defining the basic terms discussed in this study. The concepts presented below are grouped into crisis management terms and specialized terms closely related to the crisis management system.

1.1. Definitions of key terms in crisis management

Regarding the general definition of the term management, according to R.W. Griffin, this concept means "a set of activities (including planning and decision-making, organizing, leading, i.e. directing people and controlling), directed at the organization's resources (human, financial, material and information), performed with the intention of achieving the intended goals of the organization in an efficient and effective manner."[17]

[17] R.W. Griffin, *Podstawy zarządzania organizacją*, Wydawnictwo Naukowe PWN, Warszawa 2005, pp. 36–39.

According to J. Piwowarski, "crisis management is the most important part of the state's national security"[18] and in light of the Act of 26 April 2007 on Crisis Management, the term crisis management is defined as "the activities of public administration bodies that are part of national security management, which consist in preventing crisis situations, preparing to take control of them through planned actions, responding to the occurrence of crisis situations, eliminating their effects, and restoring resources and critical infrastructure."[19] According to the provisions of the Act referred to above, a crisis situation is "a situation that negatively affects the level of safety of people, property of significant size or the environment, causing significant limitations in the operation of the relevant public administration bodies due to the inadequacy of available forces and resources."[20]

Another concept closely related to the above term is crisis. The authors of the Dictionary of National Security Terms define this term as "a situation arising from a previously stable development process, threatening a loss of initiative and the necessity of accepting unfavourable conditions, requiring decisive, comprehensive remedial measures,"[21] while according to M. Nepelski, "A crisis is a turning point, a breakthrough. In a crisis situation, the indicated breakthrough will refer to the activities of a public administration body and entities performing tasks related to response."[22]

1.2. Definitions related to the crisis management system (IT/teleinformatics, information system)

The term *system* was comprehensively presented by its creator, Ludwig von Bertalanffy, according to whom: "A system is defined as a whole consisting of: the system's purpose – each system exists or is distinguished from its environment due to a specific purpose; a set of system elements – i.e., its components, distinguished according to criteria adopted by the observer of the system; a set of relationships – i.e., interactions between system elements, related to, among others, the flow of energy, matter, or information, as well as transformations occurring within the system's

[18] J. Piwowarski, *System zarządzania kryzysowego w Polsce. Wybrane aspekty*, Naukowo-Wydawniczy Instytut Badań Bezpieczeństwa i Obronności WSBPI „Apeiron" w Krakowie, Kraków–Katowice 2018, p. 9.

[19] Act of 26 April 2007 on crisis management, Dz.U. (Journal of Laws) 2023, item 122.

[20] Ibidem.

[21] *Słownik terminów z zakresu bezpieczeństwa narodowego*, Wydawnictwo Akademii Obrony Narodowej, Warszawa 2008, p. 67.

[22] M. Nepelski, *Zarządzanie w sytuacjach kryzysowych*, Wydawnictwo Wyższej Szkoły Policji w Szczytnie, Szczytno 2016, p. 16.

elements and during transitions between them; a transformation mechanism – the system, in pursuing its purpose, transforms input factors into output factors."[23]

According to D. Senczyk, "a management system is a proven structure that enables management and continuous improvement of the efficiency of the rules, procedures and processes used in a given organization"[24] and in the light of the above definitions, crisis management entities, i.e. the Polish Armed Forces and public administration should be interpreted as organizations.

The definitional chaos in the context of attempting to characterize the JASMINE CMS is primarily caused by the abundance of different approaches, as this system should be treated primarily as a crisis management system. Furthermore, it is multi-environment and automated (computerized), which also means that such a system can integrate other systems from which it will obtain the necessary data. It will also not require human intervention every time and automation processes can be implemented using artificial intelligence (AI).

Moreover, this system can be defined as an IT/teleinformation system and also as an information system, and with this approach this tool can be treated in two ways: as an element of national security management, which in Poland takes into account the five-level division of crisis management (central and local government administration)[25] coordinated with the Polish Armed Forces, and also as a system taking into account individual stages/phases of crisis management.

With the above in mind, it is also worth presenting the crisis management system from a systemic perspective. In this respect, D. Wróblewski defines this term as "an internally coordinated system of forces, resources and means allocated by the state and society, which are aimed at: preventing the emergence of crisis situations, preparing to take control over them through planned actions, efficient response in the event of their occurrence, reconstruction/reconstruction and restoring operational balance,"[26] which refers to the classic definition of crisis management, set out in the Act of April 26, 2007 on Crisis Management.[27]

---

[23] M. Kęsy, *Informacja i systemy informatyczne w działalności gospodarczej*, "Dydaktyka Informatyki" 2011, vol. 6, p. 210.

[24] D. Senczyk, *Zintegrowane systemy zarządzania w przedsiębiorstwie na wybranych przykładach*, "Przegląd Naukowo-Metodyczny *Edukacja dla Bezpieczeństwa*" 2014, no. 7, iss. 1, p. 153.

[25] G. Pietrek, *Poziomy, struktura i zadania systemu zarządzania kryzysowego w administracji rządowej*, "Zeszyty Naukowe WSOWL" 2011, no. 3(161), p. 377.

[26] D. Wróblewski, *Wybrane zagadnienia z zakresu cywilnego planowania na wypadek sytuacji kryzysowych w systemie zarządzania kryzysowego Rzeczypospolitej Polskiej*, Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej im. Józefa Tuliszkowskiego, Państwowy Instytut Badawczy, Józefów 2014, p. 43.

[27] Act of 26 April 2007 on crisis management, op. cit.

Moreover, the crisis management system should be treated as an IT/teleinformation system or information system that constitutes a platform for mutual communication between services and public administration as well as other entities that carry out tasks in the area of crisis management and a basis for broad integration capabilities with other systems.

In the first case, the CMS should perform a number of functions, in particular: "identify crisis threats by creating a catalogue of possible threats, risk assessment, determine negative consequences for people, property and critical infrastructure, define a catalogue of structural, organizational and functional measures (…); define procedures to be followed in the event of a crisis situation, prepare and maintain resources (…) for use in crisis situations, define the principles of cooperation between entities involved in crisis response."[28]

According to the authors of the PWN Online Encyclopedia, an IT system is "a set of computer systems, networks and software used to process information; an IT system typically includes a computer (one or more, connected to a network or not) with software, as well as various auxiliary devices (such as peripherals, e.g. printers, scanners, floppy disks, etc.)"[29] and, in accordance with the provisions of the Act of 18 July 2002 on the Provision of Electronic Services, an IT system is "a set of cooperating IT devices and software, ensuring the processing and storage, as well as the sending and receiving of data via telecommunications networks using a telecommunications terminal device appropriate for a given type of network."[30]

Moreover, as M. Kuraś believes, an information system is a key component of a management system.[31] A. Szaniawska and A. Grochowska add that an information system "is a spatially distinguished and temporally ordered set of senders, recipients, information and technical means of storing and transmitting information"[32] and as K. Woźniak writes, "The primary goal of an information system is to prepare data for decision-making by managers. (…) This comes down to the

[28] G. Sobolewski, *Siły Zbrojne RP w zarządzaniu kryzysowym. Aspekt narodowy i międzynarodowy*, Wydawnictwo Akademii Obrony Narodowej, Warszawa 2013, pp. 74–75.

[29] Entry *system informatyczny*, Encyklopedia PWN, https://encyklopedia.pwn.pl/haslo/system-informatyczny.html, (accessed 4.06.2025).

[30] Act of 18 July 2002 on the provision of services by electronic means, Dz.U. (Journal of Laws) 2024, item 1513.

[31] M. Kuraś, *System informacyjny – system informatyczny. Co poza nazwą różni te dwa obiekty?*, "Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie" 2009, no. 770, p. 270.

[32] A. Szaniawska, A. Grochowska, *System informacyjny w zarządzaniu współczesną organizacją*, "Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach" 2014, no. 103, p. 300.

implementation of functions such as: acquiring, collecting, analysing, and sharing information from internal and external sources."[33]

In the context of an information system as a crisis management system, E. Nowak points out that "three types of information are analysed: information held, information inflowing and information acquired."[34] These products have a significant impact on the effective management of crisis situations.

2. Characteristics, functionalities and directions of development of SZK JAŚMIN

2.1. Characteristics and functional capabilities of the SZK JAŚMIN system

SZK JAŚMIN is one of the main components of the JASMINE Network-Centric Teleinformatic Platform, which is a "large collection of mutually consistent (unified) TELDAT products, based on which, like building blocks, integrated systems can be built: combat management systems at all levels of command and military operations, as well as crisis management structures."[35]

The system was practically tested back in 2012, including during exercises organized by the National Defence University (AON), PIERŚCIEŃ 12. During these exercises, in consultation with non-military elements participating in the exercise (including the District Office in Drawsko Pomorskie), the capabilities of this system variant were demonstrated in operations carried out by public services,[36] and since then it has been used to support a number of crisis management projects in Poland.

SZK JAŚMIN features a modular and scalable architecture, ensuring the system has no limitations in terms of expansion with new functional modules. System scalability, however, depends solely on the server's hardware resources and increasing them allows for a proportional increase in resources, capacity, performance and number of users.[37]

---

[33] K. Woźniak, *Charakterystyka źródeł informacji*, in: M. Ćwiklicki (ed.), *Wprowadzenie do analizy wartości informacji*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2015, pp. 74–78.

[34] E. Nowak, *Zarządzanie kryzysowe w sytuacjach zagrożeń niemilitarnych*, Wydawnictwo Akademii Obrony Narodowej, Warszawa 2007, p. 113.

[35] *SZK JAŚMIN – Wielośrodowiskowy Zautomatyzowany System Zarządzania Kryzysowego*, Teldat, https://www.teldat.com.pl/oferta/produkty/systemy/319-szk-jasmin.html, (accessed 5.06.2025).

[36] J. Wołejszo, B. Biernacik, *Możliwości wykorzystania platformy*… op. cit., p. 390.

[37] Ł. Blechman, *System Zarządzania Kryzysowego Jaśmin. Materiały źródłowe firmy TEDAT*, Bydgoszcz 2025.

The system ensures efficient and effective management of national security/crisis management through comprehensive support for the activities of public administration bodies and the Polish Armed Forces, including the Territorial Defence Forces (TDF) during rescue and/or crisis situations and preventive actions.[38]

Key issues related to the multi-environment nature of the JASMINE CMS in crisis management structures in the territory of the Republic of Poland stem from the following aspects: international and national interoperability standards, multi-level application in the local and national context, technologies, network services and communication means used, integration with spatial information systems under the INSPIRE Directive[39] and with systems used in public administration and the Ministry of National Defence, as well as with external sources and recipients of information/images, functioning in any operating system environment, a multi-level security system and system operation by users of any organizational units and units of administration/public services.[40]

The interoperability standards[41] for this tool apply to both international and domestic services. These services include:[42] WEB, WFS, WMTS, MIP, NFFI, FFI, Link 16, NVG, BRM, VMF, HLA, DIS, HMS C3IS JASMINE, OTH-T-GOLD, CBRN, APP-6 (A/B/C/D) and the Ministry of Interior and Administration.

Web Map Service (WEB) – this international standard provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases.[43]

Web Feature Service (WFS) is an international service for downloading vector data based on user-defined criteria. The data is transmitted in the Geography Markup Language (GML) format.[44]

WMTS (Web Map Tile Service) – standard issued by the OGC (Open Geospatial Consortium) – is a geospatial data viewing service, similar to WMS. It allows users to browse spatial data via pre-rendered image fragments (tiles) generated

[38] Ibidem.

[39] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information in the European Community (INSPIRE – Infrastructure for Spatial Information in Europe), OJ L 108, 25.4.2007, pp. 1–14.

[40] Ł. Blechman, *System Zarządzania*…, op. cit.

[41] Interoperability – the ability of systems, units, or forces to provide services to, and receive services from, other systems, units, or forces, and to utilize the services so exchanged, to enable them to work together effectively (*Department of Defence Dictionary of Military and Associated Terms*, December 2003).

[42] Ł. Blechman, *System Zarządzania*…, op.cit.

[43] Open Geospacial Consortium, https://www.ogc.org/standards/wms/, (accessed 12.06.2025).

[44] Geoportal.gov.pl, https://www.geoportal. gov.pl/pl/usluga/uslugi-pobierania-wfs/, geoportal.gov.pl, (accessed 12.06.2025).

from various datasets and organized into an image pyramid. This image pyramid is created from source datasets for a specified set of map scales (zoom levels).[45]

The Multilateral Interoperability Programme (MIP) – the purpose of the Programme is to "achieve international interoperability of Command and Control Information Systems (C2IS) at all levels from corps to battalion, or lowest appropriate level, in order to support multinational (including NATO), combined and joint operations, and the advancement of digitization in the international arena". MIP is mainly driven by the operational needs of the land forces and their requirements for information exchange with navy and air force in joint operations.[46]

NATO Friendly Force Information (NFFI) – is interoperability standard which was established in 2005 by Allied Command Transformation (ACT). The main idea of this standard is enabling exchange friendly force tracks between national Command and Control Information Systems (C2IS).[47]

A Foreign Function Interface (FFI) is a programming language mechanism that allows software written in one language to use resources (functions and data structures) that were written in and compiled with a different language.[48]

LINK 16 – developed in 1994 in the US Navy and US Air Force is one of the most modern standards capable of exchanging various data formats such as text, pictures and voice among command and control locations, combat units, radar systems and all other war theatre participants provided that they are equipped with MIDS LVT –Multifunctional Information Distribution System Low Volume Terminal.[49]

Night Vision Goggles (NVG) are light image intensification devices that amplify the night-ambient-illuminated scenes by a factor of 10. For this application "light" includes visual light and near infrared.[50]

---

[45] W. Izdebski, A. Seremets, *Praktyczne aspekty infrastruktury danych przestrzennych w Polsce. Część II*, Główny Urząd Geodezji i Kartografii, Warszawa 2021, p. 26.

[46] M. Gerzp, *Multilateral Interoperability Programme MIP Test Reference System*, Fraunhofer Institute for Communication, Information Processing, and Ergonomics, Wachtberg 2009, p. 1.

[47] I. Krstićp, *Network Centric – the new weapon of the information age*, "Obronność. Zeszyty Naukowe" 2016, no. 3(19), p. 14.

[48] G. Polito, S. Ducasse, P. Tesone, T. Brunziep, *Unified FFI – Calling Foreign Functions from Pharo*, Square Bracket Associates, Lille 2020, p. 1.

[49] A. Orzoł, *The implementation of Link 16 in the Polish Armed Forces and its influence on defence capabilities, national security and image of Poland as a NATO member*, "Studia Bezpieczeństwa Narodowego" 2015, vol. 7, no. 1, pp. 104–105.

[50] D.L. Schmickley, *Night Vision Goggles*, in: C.R. Spitzerap (ed.), *The Avionics Handbook*, CRC Press, Washington 2021, p. 1.

Business Relationship Management (BRM) is a business framework that strategically cultivates positive relationships to achieve three goals: building value, developing culture, and building partnerships.[51]

The Variable Message Format (VMF) provides military services and agencies with Joint Interoperability Standards, including message, data element and protocol standards. These standards are essential for the design, development, testing, certification, implementation and continued operation of automated tactical data systems (TDS) that support the requirement to exchange timely, critical command and control information across Joint boundaries.[52]

High-Level Architecture – (HLA) provides the specification of a common technical architecture for use across all classes of simulations in the US Department of Defense. It provides the structural basis for simulation interoperability.[53]

Distributed Interactive Simulation (DIS) is used extensively in Department of Defense (DoD) modelling and simulation environments, and in many real-time platform-level wargaming communities, it is the standard for simulation interoperability. Though DIS has gained wide acceptance in the military community, it has a fairly steep learning curve for those accustomed to other non-military simulation environments.[54]

Headquarters Management System, Combat Command and Control Information System JASMINE – The Multi-Domain Automated Combat Management System at the Operational/Tactical Level HMS C3IS JASMINE is the only currently available, operational and Polish solution in this area, which additionally has the capability to provide ICT support for military operations and can be used, for example, in subunits, including their command and combat vehicles.[55]

Over-The-Horizon Targeting GOLD (OTHT-G) – the program conducts interoperability certification testing in accordance with Office of the Chief of Naval Operations (OPNAVINST) instruction.[56]

---

[51] M. Jesuthasan, *What is Business Relationship Management and How Can it Help Your Organization?*, Business Relationship Management Institute, https://brm.institute/what-is-business-relationship-management-how-does-it-help/, (accessed 12.06.2025).

[52] *Variable Message Format (VMF)*, GlobalSpec, https://standards.globalspec.com/std/14386913/mil-std-6017e-cont-dist, (accessed 12.06.2025).

[53] J.S. Dahmann, R.M. Fujimoto, *The Department of Defense High Level Architecture*, Proceedings of the 29th conference on Winter simulation (WSC '97), p. 142.

[54] J. Zywicki, D.L. Prochnow, M.R. Schumaker, A.S. Bhatti, *Expanding the Reach of Distributed Interactive Simulation (DIS) to Service Based Modeling and Simulation Environments*, Fall Simulation Interoperability Workshop 2011, p. 1.

[55] J. Kręcikij, *Wielodomenowy HMS C3IS JAŚMIN*, ZBiAM, https://zbiam.pl/ wielodomenowy-hms-c3is-jasmin/, (accessed 12.06.2025).

[56] G.E. McCown, *The Over-the-Horizon Targeting (OTH-T)*, Program and the Reconfigurable Land-

Allied Procedural Publication (APP) Symbology – this standard provides common operational symbology along with details on its display and plotting to ensure the compatibility, and to the greatest extent possible, the interoperability of NATO Land Component Command, Control, Communications, Computer, and Intelligence (C4I) systems, development, operations, and training.[57]

The multi-level nature of SZK JAŚMIN allows for its use at all levels of government and local government administration, including national, provincial, district and municipal levels. Beneficiaries of the tool include users of all organizational units and departments of public administration/services, in particular: the Government Security Centre (RCB), the CZK, the Police, the State Fire Service (PSP), the Polish Red Cross (PCK), the State Water Management Authority – Polish Waters (PGW WP), the Polish Armed Forces as well as a number of other entities performing crisis management tasks.[58]

SZK JAŚMIN operates based on the latest technologies, systems and means of communication, which include: GPS, GSM, LTE, CDMA, PSTN, UHF, VHF, HF, Satellite (applies to satellite technologies and communication systems), WiFi, Bluetooth and Ethernet.

The Global Positioning System (GPS) is a space-based positioning, navigation, and timing system developed by the U.S. Department of Defense (DoD). It emerged in the late 1960s and early 1970s as a merger of synergistic Navy and Air Force programs for timing and space-based navigation, respectively.[59]

The Global System for Mobile communications (GSM is universally accepted standard for digital cellular communication. GSM is the name of a calibration group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz this paper provides an introduction to basic GSM thoughts, conditions, networks, and facilities.[60]

The Long Term Evolution (LTE) has become the most effective wireless broadband access technology, providing wireless services to over a billion users by early 2016 and supporting a wide range of applications.[61]

Based Test Site (RLBTS) Laboratory, SSC San Diego 2021, p. 141.

[57] *APP-6A. Military Symbols for Land Based System*, Brussels 1998, p. 7.

[58] Ł. Blechman, *System Zarządzania*…, op. cit.

[59] J.G. McNeff, *The Global Positioning System*, "IEEE Transactions on Microwave Theory and Techniques" 2002, vol. 50, no. 3, p. 645.

[60] N. Sasikiran, N.G. Rao, N.R. Teja, J.K. Kumar, *Global System For Mobile Communication (GSM)*, "International Journal of Scientific Research and Management", vol. 3, iss. 4, p. 2545.

[61] B.I. Bakare, W.N. Abidde, *A Technical Review of Long Term Evolution (LTE) Operations*, "American Journal of Engineering Research" 2022, vol. 11, iss. 4, p. 133.

Code Division Multiple Access (CDMA) – code division multiple access refers to a multiple access method in which individual terminals use spread spectrum techniques and occupy the entire spectrum each time they transmit.[62]

The Public Switched Telephone Network (PSTN) is a telephone network that was developed to provide two- way voice communication to many users. It provides a means of interconnection between users. By interconnecting all users to a central switch and providing a switch to carry any other users, the number of required links can be greatly reduced. The size of any switch is a function of the number of users in that area.[63]

Radio – Ultra High Frequency (UHF) – ultra high frequencies, ranging from 300 MHz to 3 GHz.[64]

Radio – Very High Frequency (VHF) – very high frequencies, ranging from 30 MHz to 300 MHz.[65]

Radio – High Frequency (HF) – high frequencies, ranging from 3 MHz to 30 MHz.[66]

Ethernet is a technology used to connect up to a few hundred computers and devices. The connections use wires of up to 100 m or fibers of up to a few km. The bit rate on these wires and fibers is usually 100 Mbps but can go to 1 Gbps or even 10 Gbps. The vast majority of computers on the Internet are attached to an Ethernet network or, increasingly, its wireless counterpart WiFi.[67]

Additionally, SZK JAŚMIN provides the following network services: VoIP, VTC, RTMP, Email, WWW, RSS, Chat and Fax.

Voice over Internet Protocol (VoIP) is a technology that allows users to make telephone calls over the Internet or intranets. This technology does not use the traditional public switched telephone network (PSTN); instead, calls are placed over the Internet Protocol data network.[68]

---

[62] T. Heikkilä, CDMA – *Code Division Multiple Access*, http://www.comlab.hut.fi/opetus/333/2004_2005_slides/CDMA_text.pdf, (accessed 12.06.2025).

[63] J.C. Ogbulezie, N.A. Akonjom, A. Ojomu, A.O. Ezugwu, *The Bane of Public Switch Telephone Network (PSTN) in Nigeria*, "International Journal of Research in Engineering and Science", vol. 4, iss. 7, p. 1.

[64] *Frequency Bands: The differences between HF, UHF and VHF*, SMC Group, https://smcgroupglobal.com/frequency-bands/, (accessed 12.06.2025).

[65] Ibidem.

[66] Ibidem.

[67] J. Walrand, S. Parekh, *Communication Networks. A Concise Introduction*, University of California, Berkeley 2018, p. 29.

[68] U.R. Alo, N.H. Firday, *Voice over Internet Protocol (VOIP): Overview, Direction and Challenges*, "Journal of Information Engineering and Applications" 2013, vol. 3, no. 4, p. 18.

Video Teleconferencing (VTC) is an interactive multimedia communication, usually carried out using computers, consisting in the transmission of images and sound at high speed in real time between remote locations.[69]

Real-Time Messaging Protocol (RTMP) is a protocol for streaming content from one platform so that it appears on another.[70]

Really Simple Syndication (RSS) is an XML based system which uses standard web format to allow users to subscribe to websites from which they get frequently updated information: audio, news headlines, video, blog entries, etc.[71]

SZK JAŚMIN can run on any operating system: Windows, Linux, Android, macOS and has a multi-level security system based on the following protocols/ standards: PKI, VPN, IPSec, SSL/TLS, authorization, authentication, software licensing and source code encryption.

Public Key Infrastructure (PKI) is a way of providing security measures by implementing the means of key pairs among users. The public key infrastructure is discussed that includes various components and operation, some well known PKIs and their comparisons.[72]

The Virtual Private Network (VPN) is a rapidly developing technology that has a crucial function in guaranteeing the secure transfer of data. A virtual linkage is created among geographically distant individuals and networks that are linked through a common or public network, such as the Internet.[73]

Internet Protocol Security (IP Security) – is a widely used network layer security control for protecting communications. IPsec is a framework of open standards for ensuring private communications over Internet Protocol (IP) networks. IPsec configuration is usually performed using the Internet Key Exchange (IKE) protocol.[74]

---

[69] Entry *wideokonferencja*, Wikipedia, https://pl.wikipedia.org/wiki/Wideokonferencja, (accessed 13.06.2025).

[70] D. Murphey, *Wprowadzenie do Webex Events RTMP Player*, Webex Events Academy, https://help.socio.events/pl/articles/4348408-wprowadzenie-do-webex-events-rtmp-playerio.events, (accessed 14.06.2025).

[71] A. Abdul-Barikp, F. Yussif, M.S. Bipembi, *Deployment of an Enhanced Web-based Really Simple Syndication (RSS) Aggregator*, "International Journal of Computer Applications" 2022, vol. 184, no. 23, p. 1.

[72] A. Albarqi, E. Alzaid, F. Al Ghamdi, S. Asiri, *Public Key Infrastructure: A Survey*, "Journal of Information Security" 2015, vol. 6, no.1, p. 31.

[73] S. Banerjee, R.R.S. Makwana, *Virtual Private Network: Survey and Research Challenges*, "International Journal of Latest Technology in Engineering, Management & Applied Science" 2025, vol. 14, iss. 6.

[74] E. Barker, Q. Dang, S. Frankel, K. Scarfone, *Guide to IPsec VPNs*, National Institute of Standards and Technology, Gaithersburg 2020, p. 4.

Authorization is the process that determines what an authenticated identity is permitted to do within a system. After authentication verifies identity, authorization defines the actions, access levels, and privileges granted to a user, application, or device. It establishes the boundaries within which an identity can operate.[75]

Authentication is the process of proving that the user with a digital identity who is requesting access is the rightful owner of that identity. Depending on the use-case, an 'identity' may represent a human or a non-human entity; may be either individual or organizational; and may be verified in the real world to a varying degree, including not at all.[76]

Software licensing is the process of formally granting the right to use software by its creator or copyright holder. A license specifies the terms under which a user may use the software, including the scope of use, restrictions and any fees associated with its use. Licensing is a key aspect of intellectual property protection and ensures that software is used legally.[77]

Source code encryption – the mechanism of protecting a source code is considered as an essential factor for all the security system in a certain kind of an age which is governed by all advances in terms of a big data technology.[78]

The multi-environment nature of the JASMINE Crisis Management System in Polish territory also involves integration with spatial information systems under the INSPIRE Directive,[79] integration with systems used in public administration and the Ministry of National Defence, as well as with external sources and recipients of information/images.[80] System integration under the INSPIRE Directive applies to the following institutions/offices: IMGW (Institute of Meteorology and Water Management), GIOŚ (Chief Inspectorate for Environmental Protection), GDOŚ (General Directorate for Environmental Protection), GUGiK (Head Office of Geodesy and Cartography), PIG (Polish Geological Institute), IBL (National Heritage Institute), GDDKiA (General Directorate for National Roads and Motorways), NID (National Heritage Institute), GUS (Central Statistical Office) and NSIS (National Satellite Information System).

---

[75] Y. Laygude, What *Is Authorization? Definition, Process, and Examples*, Tech Prescient, https://www.techprescient.com/blogs/authorization/, (accessed 15.06.2025).

[76] M. Morowczynski M. Epping, *Authentication and Authorization*, IDPro Body of Knowledge, Wakefield 2021, p. 2.

[77] *Co to jest Licencjonowanie opr…*, Ardura Consulting, https://ardura.pl/slownik/licencjonowanie-oprogramowania/, (accessed 15.06.2025).

[78] P. Sindu, R. Khan, *Cybersecurity to Protecting Source Code*, Gannon University, Erie 2023, p. 2.

[79] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information in the European Community (INSPIRE – Infrastructure for Spatial Information in Europe), OJ L 108, 25.4.2007, pp. 1–14.

[80] Ł. Blechman, *System Zarządzania*…, op. cit.

The JASMINE school can be integrated with the following public administration and Ministry of National Defence systems: QGIS, SWD-ST, SWD Policji, SWD PRM, RSO, ATAKciv, SBWI lub SARON, DART, SIRON, NSIS, SIPAM, ISOK and with external sources and recipients of information/images, including drones and rescue cameras, city monitoring sensors, measurement stations and channels,[81] as well as with alarm and notification systems.[82]

QGIS – a free and open geographic information system that allows the creation, editing, visualization, analysis and publishing of spatial information, including publishing map compositions online. It supports numerous functions and formats: vector, raster and database.[83]

A domain-specific SWD-class system (command support system – SWD-ST) designed for district and municipal headquarters of the State Fire Service. The software's functional and informational scope covers all areas of the State Fire Service's operations. The primary purpose of the SWD-ST system is to support on-duty personnel in handling calls and incidents, coordinating rescue operations and preparing documentation of completed operations.[84]

The Police Command Support System (Police SWD) is an ICT system supporting the performance of statutory tasks undertaken in particular on the basis of reports received by duty police organizational units and other police officers, findings made by individual police services in connection with these reports and information obtained in connection with the handling of emergency reports received from emergency notification centres.[85]

The State Emergency Medical Services Command Support System (SWD PRM) is a uniform IT system across the country enabling the receipt of alarm calls, event notifications, dispatching medical rescue teams, recording medical events, presenting the geographical location of the event site, real-time positioning of medical rescue teams and supporting the implementation of tasks by medical rescue teams and the provincial medical rescue coordinator.[86]

---

[81] RSS, TV i RADIO.

[82] Ł. Blechman, *System Zarządzania*…, op. cit.

[83] *QGIS – poradniki, instrukcje*, Portable info PL, https://portable.info.pl/qgis-poradniki-instrukcje/, (accessed 15.06.2025).

[84] *SWD-ST. System Wspomagania Decyzji Państwowej Straży Pożarnej*, Abacus, https://abakus.net.pl/oferta/swd-st, (accessed 15.06.2025).

[85] Order No. 12 of the Police Commander-in-Chief of 19 May 2020 on the Police Command Support System, Dz.U. (Journal of Laws) 2020, item 23.

[86] Krajowe Centrum Monitorowania Ratownictwa Medycznego, *System Wspomagania Dowodzenia Państwowego Ratownictwa Medycznego (SWD PRM)*, https://www.kcmrm.pl/swdprm/, (accessed 15.06.2025).

The Regional Warning System (RSO) is a free, universal service provided by the Ministry of Interior and Administration in cooperation with Telewizja Polska S.A., enabling citizens to be notified of threats. The RSO contains various types of messages, including meteorological, hydrological and other warnings related to local threats, such as road accidents.[87]

The Android Team Awareness Kit (ATAK), intended for civilian or military use, is a software kit that provides geospatial information and enables users to collaborate in the field of geography.[88]

The Secure Information Exchange System (SBWI or SARON) is the only mature and systematically developed Polish solution of its kind, constituting a distributed collection of specialized software and hardware products. It is primarily used for the extensive, fast and secure exchange of information initiating and reporting specific, desired and necessary actions in public services, e.g., national defence and/or crisis management.[89]

DART – a tool for managing public safety – recording and monitoring public events and incidents and coordinating the activities of city services (City and Municipal Guards and the CZK). It enables the positioning of vehicles and patrols on a digital city map using satellite systems, dedicated locators and radio-telephones. Equipped with a range of functionalities.[90]

SIRON is an application supporting the search for missing persons in open areas. It allows for live tracking of field teams' positions and identifies the searched area.[91]

The National Satellite Information System (NSIS) is a national interoperable system for receiving, storing, processing and sharing satellite data along with the necessary infrastructure, launched by the Polish Space Agency.[92]

The Spatial Information System of the Maritime Administration (SIPAM) contains an updated set of bathymetric data for Polish maritime areas. Data resolution is 50 meters for areas where such resolution is available.[93]

---

[87] Ministerstwo Spraw Wewnętrznych i Administracji, *Regionalny System Ostrzegania*, https://www.gov.pl/web/mswia/regionalny-system-ostrzegania, accessed 15.06.2025).

[88] *CivTAK / ATAK*, Civilian | News, Licensing, Support & Download for ATAK / TAK Tools and Plugins, (https://www.civtak.org/category/plugins/, TAKciv – civilian version of the system, (accessed 15.06.2025).

[89] *System SEIS – Secure Exchange Information System*, TELDAT, https://www.teldat.com.pl/oferta/produkty/systemy/101-sbwi-saron.html, (accessed 15.06.2025).

[90] *DART – system zarządzania bezpieczeństwem publicznym*, Sprint, https://sprint.pl/pl/uslugi/system-zarzadzania-bezpieczenstwo-publicznym-dart, (accessed 15.06.2025).

[91] *SIRON – wspierając poszukiwania*, https://poszukiwania.org/, (accessed 15.06.2025).

[92] Polsa, *Narodowy System Informacji Satelitarnej*, https://polsa.gov.pl/aktywnosci/obserwacja-ziemi/nsis/, (accessed 16.06.2025).

[93] *System Informacji Przestrzennej Administracji Morskiej*, SIPAM, https://sipam.gov.pl/, (accessed

The National Protection System (ISOK) is a portal enabling users to view and analyse data published by IMWM-PIB (Institute of Meteorology and Water Management, National Research Institute) regarding current meteorological and hydrological warnings and meteorological hazard maps (MZM). The portal supports tasks carried out by the State Water Management Authority (PWD).[94]

The documents that should support the system's functionalities can be grouped into: legal acts (international, EU, national, internal (ministerial); planning acts (Crisis Management Plans (CMP): national, RON, voivodeship, district, municipal and Organizational Unit Protection Plans) and others: Reports on National Security Threats, National Critical Infrastructure Protection Programme; Instructions/ Regulations/Security Policies, etc.[95]

Dedicated specialist positions/functionalities implemented in the JAŚMIN Training Centre include the following areas: civil planning; logistic support; monitoring, forecasting and analysis of operations and organization of activities; critical infrastructure management; alerting/notifying about threats; management and protection of monuments; health care and social and living assistance.[96] The type of active (key) functionalities of the system are presented below:[97] real-time visualization of the crisis/operational situation on digital maps; using the component and mapping tools (OSM, Google, Mapbox Dark, and ORTO);[98] possibility of setting map compositions;[99] creating a unified picture of the crisis/operational situation; creating a combined picture of the crisis/operational situation;[100] integration of video image sources available in the area of operations: drones (FlyEye, microdrones DJI and TB2), city cameras and rescue cameras; planning and visualizing the directions of activities (tasks of CIMIC groups,[101] evacuation, rescue, reconnaissance, manned and unmanned reconnaissance flights); integration of external geospatial data/metadata from national and EU systems, in accordance with the INSPIRE Directive,[102]

16.06.2025).

94 *ISOK chroni kraj*, ISOK, https://www.gispartner.pl /pf/isok/, (accessed 16.06.2025).

95 Ł. Blechman, System Zarządzania…, op. cit.

96 Ibidem.

97 Ibidem.

98 The following functionalities are available: measurement tools, drawing objects and a mini-map function.

99 Dedicated/situational, freely configurable by the user.

100 Data obtained in cooperation with the Road and Bridge Research Institute and information collected and provided by reconnaissance groups.

101 Civil-Military Co-operation (CIMIC) – civil-military cooperation, carried out in times of peace, crisis and war within the country and abroad (Doktryna współpracy cywilno-wojskowej Sił Zbrojnych RP DD/, MON, Warszawa 2004, p. 7).

102 Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establish-

meteorological and hydrological (IMGW), satellite (COPERNICUS);[103] integration of cooperation with other IT systems used by Public Administration Units;[104] replaying the course of performed activities on the timeline (AAR[105]); hierarchical ordering and aggregation of data collected in the system on operational and raster layers; depiction of all units, forces and resources, phenomena, threats and tactical actions;[106] possibility of using the CHAT Messenger (XMPP), including integration with the ATAKciv application; possibility of using information channels;[107] possibility to present alarm states and levels;[108] file repository;[109] route search option;[110] ability to search for objects;[111] possibility of using a dedicated mobile application intended for use on any mobile device;[112] possibility of creating PZK; filtering data of military units/institutions by given parameters.

OpenStreetMap (OSM), is a collaborative internet mapping project that collects geospatial data to create and distribute online maps, freely available to anyone with internet access.[113]

Mapbox Dark is a subtle map designed to provide geographic context while highlighting data on an analytics dashboard, data visualization or data overlay.[114]

An orthophotomap (ORTO) is a raster image of the terrain surface, created by processing aerial or satellite images. In Poland, the body responsible for maintaining the

---

ing an Infrastructure for Spatial Information in the European Community (INSPIRE), OJ L 108, 25.4.2007, pp. 1–14.

[103] The Copernicus Programme is the EU's Earth observation programme, which analyses our planet and its environment to maximize the benefits for all EU citizens. The programme is coordinated and managed by the European Commission. It is implemented in cooperation with Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU agencies and the Mercator Océan research institute (*Informacje o programie Copernicus*, Copernicus, https://www.copernicus.eu/pl/informacje-o-programie-copernicus, accessed 16.06.2025).

[104] For example: QGIS, NSIS, SIPAM, ISOK, and the Polish Army (SARON, ATAKciv).

[105] After Action Review.

[106] Using symbology compliant with NATO standards (APP6), national standards of the Ministry of Interior and Administration (in accordance with Decision No. 13 of the Minister of Interior and Administration of 28 January 2008), as well as any graphics imported by the user (symbols/icons in graphic formats, e.g. SVG, PNG, JPG).

[107] RSS/ATOM, TV, RADIO.

[108] Possibilities of automated announcement and display of alarm states and levels, specifying the exact areas and places where they apply.

[109] Centralized data cloud: documents/files.

[110] Evacuation, access, alternatives.

[111] Possibility of freely searching all objects collected in the system.

[112] For example: smartphones and tablets, enabling work in real time and offline.

[113] K. Curran, J. Crumlish, G. Fisher, *OpenStreetMap*, "International Journal of Interactive Communication Systems and Technologies" 2016, no. 2(1), p. 70.

[114] *Dark*, Mapbox, https://www.mapbox.com/maps/dark, (accessed 16.06.2025).

orthophotomap database under the Act of 17 May 1989, Geodetic and Cartographic Law, Dz.U. (Journal of Laws) 2024, item 1151, is the Surveyor General of Poland. Currently, the most accurate orthophotomaps available from the State Geodetic and Cartographic Resource (PZGIK) represent a 3 x 3 cm area in a single pixel of their image.[115]

FlyEye is a miniature unmanned aerial vehicle (UAV) designed and built by WB Electronics to provide advanced air reconnaissance capabilities to armed forces and special operations forces.[116]

DJI drones are designed for individuals and companies involved in professional video and photography production, site surveying, building inspections and other fields requiring advanced equipment with field flight. DJI drones are characterized by high-quality build, flight stability, precise navigation systems, extensive camera equipment and various sensors and solutions enabling long-range control.[117]

Bayraktar (TB2) is a tactical armed/unmanned aerial vehicle system developed and manufactured by the Turkish company Baykar. The system consists of the Bayraktar TB2 armed/unmanned aerial vehicle platform, a ground control station, a ground data terminal, a remote display terminal, an advanced base with generator modules and a trailer.[118]

SZK JAŚMIN functionalities presented above have been grouped into functional modules, the most important of which is the map module. This module is arguably the most extensive, but this does not diminish the importance of the remaining functional modules in the context of the overall system's operation. The specifics and capabilities of the map module are presented below:[119] operational layers (cataloguing of resources, databases on forces and resources, units, mobile objects, areas, administrative boundaries, specialized data, metadata, multimedia references, contact details, management of permissions for specific groups or individual users, etc.); raster layers;[120] map compositions; measuring tools (distances, areas) in any units of measurement; coordinates in various standards: WGS84, DMS, MGRS and UTM; tools for drawing arbitrary shapes, lines, point and area objects, and

[115] *Ortofotomapa (ORTO)*, geoportal.gov.pl, https://www.geoportal.gov.pl/ pl/dane/ortofotomapa-orto/, (accessed 16.06.2025).
[116] *Fly Eye Uncrewed Aerial System (UAS), Poland*, Army Technology, https://www.army-technology.com/projects/fly-eye-unmanned-aerial-vehicle/, (accessed 16.06.2025).
[117] *Drony DJI*, Flystore, https://flystore.pl/Drony-DJI, (accessed 16.06.2025).
[118] *Bayraktar TB2*, Baykar, https://baykartech.com/en/uav/bayraktar-tb2/, (accessed 16.06.2025).
[119] Ł. Blechman, *System Zarządzania*…, op. cit.
[120] Geospatial data integrated with external systems, including, for example, flood hazards, shelters, fire hydrants, alarm sirens, healthcare facilities, power, road, rail and maritime infrastructure.

a mini-map; map bases;[121] tabular summaries of layers/operational data (with the possibility of exporting to Excel format); timeline;[122] importing/exporting layers/operational data to various formats.[123]

The World Geodetic System 1984 (WGS84), a three-dimensional coordinate reference system used to establish latitude, longitude, and elevation for navigation, positioning and targeting for the Department of Defence, International Civil Aviation Organization, NATO, International Hydrographic Office, and International Civil Aviation Organization, is used by GPS systems worldwide.[124]

DMS is the traditional format of coordinates expressed in degrees, minutes and seconds.[125]

The Military Grid Reference System (MGRS) is a geocoordinate standard used by NATO armies to locate points on Earth. MGRS is derived from the Universal Transverse Mercator (UTM) grid system and the Universal Polar Stereographic (UPS) grid system.[126]

Universal Transverse Mercator (UTM) is a global map projection system used for detailed and accurate mapping. The system divides the Earth into 60 zones, each 6° longitude wide. The zones are numbered from 1 to 60, starting at 180° longitude west and increasing eastward.[127]

The remaining functional modules of the discussed system are: Geoserver Module, CHAT Module, Alarm/Notification Module, Operational Symbology Module,[128] Accommodation management module,[129] Hospital module, Warehouse module, Search/Route planning module, Tracking module,[130] Reporting module,[131] Integration module with external systems,[132] Integration module with external/specialized

[121] OpenStreet, Satelitarne ortofotomapy, Google, Darkmap itp.
[122] Replaying the course/history of routes of moving mobile units.
[123] XML, JSON, GML, GEOJSON, KML, KMZ, compliant with GIS standards (Google, OpenStreet, QGIS, ArcGIS etc.).
[124] *World Geodetic System 1984 (WGS 84)*, Office of Geomatics, https://earth-info.nga.mil/index.phpdirwgs84actionwgs84, (accessed 16.06.2025).
[125] https://mylocationmap.com/pl/gps-coordinates-converter/, (accessed 16.06.2025).
[126] *MGRS, UTM and WGS84 Coordinate Grid on a Map*, MAP. ARMY, https://www.map.army/doc/en/map/coordinategrid/, (accessed 16.06.2025).
[127] *Konwerter Współrzędnych GPS*, MyLocationMap.com, https://mylocationmap.com/pl/gps-coordinates-converter/; *UTM Zone Finder: What UTM Zone Are You In?*, MAPSCAPING, https://mapscaping.com/utm-zone-finder/, (accessed 16.06.2025).
[128] APP6, Ministry of Interior and Administration, threats, SVG proprietary symbols.
[129] E.g. facilities for refugees, social and living assistance, etc.
[130] Tracking of mobile objects/units (vehicles, flying objects, floating objects, rescuers, soldiers, firefighters, etc.).
[131] With the ability to create templates, define default assortments/forces and resources.
[132] Compliant with the EU INSPIRE directive, e.g. national and EU geoservices/geoportals.

systems (e.g. AIS, ADS-B, PansaUTM/ PAŻP, TRAFFIC, WINDY and AIRLY), Video monitoring module,[133] VTC module,[134] Information channels module,[135] Mobile application module,[136] Integration Module/ Gateway,[137] Integration module with simulation systems (e.g. ETC-PZL[138]), Message/ Notification Module,[139] METEO/ HYDRO/SATELLITE module – integration with weather, meteorological, hydrological and satellite imaging systems (e.g. ICEYE[140] and COPERNICUS[141]), 3D models module[142] and User management and monitoring module.[143]

Automatic Identification System (AIS) is a ship radar which is an automated tracking system widely used at sea. The system collects static and dynamic information from ships and enables electronic data exchange between AIS stations.[144]

ADS-B – Dependent Surveillance-Broadcast, the system provides aircraft identification, position, altitude, speed and other information to any receiver (airborne or ground-based) within range. The broadcast aircraft position/speed is typically based on a global navigation satellite system (GNSS) and transmitted at least once per second.[145]

PansaUTM – Dynamic Airspace Control, a drone traffic management system developed by the Polish Air Navigation Services Agency. PansaUTM integrates

---

[133] Video streaming, city cameras, rescue cameras, drones, simulations, archived video.

[134] Video conference.

[135] RSS/ATOM.

[136] With the ability to work in Offline/Online mode.

[137] ATAKciv.

[138] The Polish company ETC-PZL Aerospace Industries Sp. z o.o. designs and builds simulators, training devices and specialized software for the military and public order services worldwide (*ETC--PZL Aerospace Industries – Nowoczesne symulatory o unikalnych konfiguracjach i możliwościach treningowych*, ZBiAM – Zespół Badań i Analiz Militarnych, https://zbiam.pl/etc-pzl-aerospace-industries-nowoczesne-symulatory-o-unikalnych-konfiguracjach-i-mozliwosciach-treningowych/, accessed 5.06.2025).

[139] About alert states and levels, new objects and events.

[140] The ICEYE constellation is a microsatellite-based system designed for continuous, near-real-time monitoring anywhere on Earth (V. Ignatenko et al, *ICEYE Microsatellite SAR Constellation Status Update: Evaluation of First Commercial Imaging Modes*, IGARSS 2020 – 2020 IEEE International Geoscience and Remote Sensing Symposium Espoo, Finland 2020, p. 2).

[141] The Copernicus satellite Earth observation system, which is able to warn against weather crises (*KE ostrzegała przed powodziami. Dane pochodziły z satelitów*, Space 24, https://space24.pl/satelity/obserwacja-ziemi/ke-ostrzegala-przed-powodziami-dane-pochodzily-z-satelitow, accessed 5.06.2025).

[142] Areas, objects, flood simulation, etc.

[143] Ł. Blechman, *System Zarządzania*…, op. cit.

[144] *Radar statków – Śledzenie statków*, skyradar.pl, https://www.skyradar.pl/p/ruch-statkow-sledzenie-na-morzu.html, accessed 17.06.2025).

[145] M.A. Ávila, *Automatic Dependent Surveillance – Broadcast (ADS-B)*, https://www.icao.int/NACC/Documents/ Meetings/2023/ECARNTG12/ECARNTG12-P-2.pdf, p. 6, (accessed 19.06.2025).

data from KSID (Krajowy System Informacji Dronowej) and enables: real-time flight reporting; dynamic airspace updates; integration with other systems.[146]

TRAFFIC is a layer of information about road traffic conditions. It allows the checking of traffic volume, obtaining information on speed and road events (e.g., accidents) that affect road conditions. This data is continuously updated and displayed live on a map.[147]

WINDY – this is a weather radar that shows the current weather and upcoming forecasts (wind, rain, storm, temperature, cloud cover, air quality).[148]

AIRLY – a real-time air quality mapping system for large urban areas using innovative interpolation algorithms and innovative sensor networks.[149]

The current version of SZK JASMINE is implemented on servers owned by TELDAT and leased as an external service. There are no formal or technical obstacles to ultimately implementing the system on servers designated by the client, either on TELDAT's own resources or leased by TELDAT, which can be contracted with a certified server service provider holding, for example, a Level I Industrial Security Certificate for SECRET/NATO SECRET/EU SECRET classification.[150]

The system has the following interoperability protocols/standards implemented: WMS/WFS (Geoserwer), XMPP (Chat), GML/KML/KMZ, GeoJSON, GeoTIF and CoT.

Extensible Messaging Presence Protocol (XMPP). This is a protocol for streaming XML elements over a network for near-real-time message exchange and information presentation.[151]

GML (Geography Markup Language) is a geographic markup language that defines a set of spatial (geographic) features recorded in the XML format. XML schemas are used to describe spatial objects, defining the core properties of the stored features. These schemas are saved in files with the XSD (XML Schema Definition) extension.[152]

---

[146] *3 podstawowe narzędzia cyfrowe dla pilotów i operatorów dronów od PAŻP i ULC. Praktyczny przewodnik*, Drony Dla Firmy, https://dronydlafirmy.pl/dronetower-i-inne-narzedzia/, (accessed 19.06.2025).

[147] *Traffic*, emapa, https://opis.emapi.pl/obsluga-emapi/traffic/, (accessed 19.06.2025).

[148] *Windy: radar pogodowy online. Jak korzystać z aplikacji Windy?*, SUPERexpress, https://pogoda.se.pl/windy-aplikacja-z-radarem-pogodowym, (accessed 19.06.2025).

[149] *Spełnienie wymogów jakości powietrza jest możliwe*, airly, https://airly.org/pl/o-airly/, (accessed 19.06.2025).

[150] Ibidem.

[151] *XMPP Protocol*, GeeksforGeeks, https://www.geeksforgeeks.org/ html/xmpp-protocol/, (accessed 19.06.2025).

[152] W. Izdebski, *Implementacja GML w praktyce*, Politechnika Warszawska, Geo-system Sp. z o.o, Warszawa 2013, p. 2.

Keyhole Markup Language (KML) is an XML-based language for managing the display of 3D geospatial data. KML has been adopted as an OGC standard and is supported by major GeoBrowsers.[153]

Keyhole Markup language Zipped (KMZ) is a compressed version of the Zip file of KML, which is responsible for storing locations on a map that can be viewed in various geographic information system (GIS) applications in all Google Earth programmes.[154]

A JavaScript Object Notation (JSON)-based format designed to represent geographic features with their non-spatial attributes. This format defines various JSON objects and how they are combined. JSON represents aggregate information about geographic features, their spatial extent and their properties.[155]

Geo Tagged Image File Format (GeoTIFF) is a TIFF format with embedded georeferenced data (geographic coordinates, geocentric coordinates, projected coordinates and vertical coordinates) used to position the image in the appropriate spatial location and geometry on the screen.[156]

Curser On Target (COT), the use of the CoT protocol in the TAK application allows for immediate integration of military and civilian systems, for joint action by soldiers, officers and civilians during a natural disaster, crisis or search and rescue operation.[157]

Furthermore, integration with other TELDAT products is possible, including: the JASMINE C3IS (UNCLASSIFIED network) with the HMS C3IS JASMINE software (CLASSIFIED network), which complies with dozens of NATO interoperability standards. Information exchange between systems can be achieved using the sanitizer functionality implemented in the HMS C3IS JASMINE software, released in December 2023. Additionally, interoperability with the HMS C3IS JASMINE software can be achieved through a specialized gateway.[158]

The tool is currently used operationally by the entire WOT structure (approximately 500 dedicated accounts/users), public administration and eight teaching and training laboratories at state universities in Poland (over 200 dedicated licenses).

---

[153] *KML – Keyhole Markup Language*, https://gdal.org/en/stable/drivers/vector/kml.html, (accessed 19.06.2025).

[154] *KMZ (Keyhole Markup Language Zipped)*, GISBOX, https://itigic.com/pl/kmz-file-what-is-it-how-to-create-open-and-edit-in-windows/, (accessed 19.06.2025).

[155] *What is a GeoJSON file*, FILEFORMAT, https://docs.fileformat.com/gis/geojson/, (accessed 19.06.2025).

[156] *Format GeoTIFF,* DATAGIS.PL, https://www.datagis.pl/strona/geotiff, (accessed 19.06.2025).

[157] *TAK dla bezpieczeństwa Polski*, Wydawnictwo AVT, https://elportal.pl/blog/krwiostki/7540-tak-dla-bezpieczenstwa-polski, (accessed 19.06.2025).

[158] Ł. Blechman, *System Zarządzania*…, op. cit.

Administrators only need one day to install and configure the system within the prepared server infrastructure. In the client/web version, launching the product involves simply logging in to the system using a web browser.[159]

It should also be noted that the system manufacturer has appropriately qualified engineering staff within its functional units,[160] which ensures the ability to implement, maintain and further develop this system. Should the needs grow and/or the time needed to complete system maintenance and development tasks shorten, engineering resources will be adjusted and scaled proportionally to those needs.[161] The main advantages, potential and achievements of SZK JAŚMIN are presented below:[162] the system implemented and operated continuously from 2022 in public administration;[163] the system was used by the Territorial Defence Forces on a continuous basis as part of Operation FENIKS; the system was used in numerous crisis response exercises in Poland,[164] the system has been qualified to participate in the largest international allied interoperability exercises CWIX[165] 2025 to work in the NATO SECRET classified network; the system has been implemented and is used for teaching activities in educational and training laboratories at many universities in Poland; the system is fully Polish, built on the basis of the SWD C3IS JASMINE command system, continuously developed with the latest technologies, standards and functionalities; the system was submitted for use as part of a European Space Agency project[166] for the purposes of developing integration with the Copernicus system; the system was submitted to the international forum of the United Nations (UN) as a practical solution within the framework of the eighth global platform for disaster risk reduction.

---

[159] Ibidem.

[160] Department of Technological Development, Department of Innovative Information Technologies, Department of Quality Management, Department of System Implementation and Maintenance.

[161] Ł. Blechman, *System Zarządzania*…, op. cit.

[162] Ibidem.

[163] In the Kuyavian-Pomeranian Voivodeship and Koszalin County.

[164] For example: in the 9th Łódź Territorial Defense Brigade (9 ŁBOT), in the 8th Kujawsko-Pomorskie Territorial Defense Brigade (8 K-PBOT), in the 11th Małopolska Territorial Defense Brigade (11 MBOT) and the exercises: SAMORZĄD 2024, CHEŁMŻA 2024, BIESZCZADY 2024, HURAGAN 2025, KRYZYS 2025.

[165] Coalition Warrior Interoperability eXploration, eXperimentation, eXamination eXercise (CWIX), is an annual event approved by the NATO Military Committee, held primarily at the Joint Force Training Centre (JFTC) in Bydgoszcz, aimed at continuously improving the Alliance's interoperability (R. Palka, *Koncepcja rozwoju Systemu Wspomagania Dowodzenia HMS C3IS JAŚMIN Wojsk Lądowych w działaniach sojuszniczych i koalicyjnych* [doctoral dissertation], Akademia Kaliska, Kalisz 2023, p. 102).

[166] The European Space Agency (ESA).

2.2. Directions of development of SZK Jasmin

The manufacturer based the system's operation on a modular system architecture. Thanks to these choices, the creator of the tool in question provides elements such as server and client software, functionalities and services for personnel operating on a macro scale (e.g., nationwide) and micro/local (e.g., mobile in the field). As a result, the system's architecture allows for flexible, easy expansion with new, unique functionalities/modules, as well as additional workspaces.[167]

Moreover, thanks to the tool's flexibility and modular architecture, SZK JASMIN allows for quick and easy adaptation to user requirements and provides the ability to integrate with other systems operating on various communication and IT resources, particularly mobile ones. This allows SZK JAŚMIN to be successfully used in the event of damage or destruction of stationary ICT infrastructure, as was the case during the floods in southwestern Poland in September 2024. Detailed directions for system improvement and development are included in the table below:[168]

Developing the system's capabilities for use in NATO exercises (CWIX). In this regard, a wide range of operational, functional and mobile tests of the JASMINE MILITARY CAMP have been planned in many specialized, dedicated areas (FOCUS AREAS), e.g. MIP, OpsCmd, CYBER (Cyber Defence), SPACE (space domain), LAND (land domain), AIR (air domain), MARITIME (maritime domain), FFT, COMMS, MandS, ODN, GeoMetOc (geographical, meteorological and oceanographic information) and Log-Med (logistics – medical – movement and transportation).

Multi-Domain Command and Control is a strategy for the simultaneous integration and coordination of command and control operations in air, land, sea, space, cyber and electromagnetic domains.[169]

Friendly Force Tracking (FFT) is a military operations strategy for locating, distinguishing and tracking the movements and activities of friendly forces in real time during hostilities or operations.[170]

Communications (COMMS), a term referring to the transmission of information by various means such as speech, writing, signals or technology is commonly used in fields such as telecommunications, military operations and corporate environments,

[167] Ł. Blechman, *System Zarządzania*…, op. cit.
[168] Ibidem.
[169] D.A. Bray, *Delivering on the Vision of Multi-Domain Command and Control*, www.businessofgovernment.org, (accessed 17.06.2025).
[170] *Friendly force tracking (FFT)*, BENEFITS.COM, https://benefits.com/glossary/friendly-force-tracking-fft/, (accessed 16.06.2025).

often denoting systems or processes involved in effective communication. Related categories include Business, Technology, and Military.[171]

Modelling & Simulation (MandS) is a pervasive discipline that lays the computational foundations for real and virtual experiments, clearly defining the boundaries – and interactions – of systems, data and representations. The field is also well known for its training support through simulations and simulators.[172]

Overlay Distribution Networks (ODNs) are a modern implementation concept for content distribution networks. They rely on leasing transport and server resources from server and network providers to establish an overlay network of virtual servers and virtual link interconnections, which is then used to deliver content in a manner similar to traditional networks.[173]

Readiness of system administrators to support the UN under the Eighth Global Platform for Disaster Risk Reduction.

Further development based on the latest technologies and functionalities of satellite imaging as part of participation in the EAK project.[174]

Further development of the training and education system.

Expanding the system with the Portable Training and Education System Integrator.[175]

Expanding the system with an AI module.[176]

Expanding the system with a module for managing and protecting cultural assets. This module will include functionalities for recording and managing immovable, movable, and archaeological monuments, as well as those listed on the

[171] *What Does COMMS Stand For? All COMMS Meanings Explained*, ALLACRONYMS, https://www.allacronyms.com /COMMS/Communications, (accessed 17.06.2025).

[172] *Modeling and Simulation*, SPRINGER NATURE, https://link.springer.com/book/, (accessed 19.06.2025).

[173] *Optical Network Terminal & ODN Explained*, TTIFiber, https://ro.uow.edu.au/articles/thesis/, (accessed 19.06.2025).

[174] For example, in the field of real-time integration of COPERNICUS and ICEYE systems, as well as specialized drones.

[175] This is a Mobile Crisis Management Centre (a hardware module, in a suitcase, equipped with comprehensive, independent SZK stations for operations in critical, field conditions, ensuring the integration of radio communication means, GSM, satellite and WiFi). The integrator enables the integration of all available communication means and provides a wide range of SZK JAŚMIN services, including map imaging, force and asset management, communications, audio/video transmission and GPS positioning, as well as alarm and notification.

[176] This functionality enables automated analysis of images, video streams and specialized hydrological and meteorological data to detect threats and potential dangerous phenomena from any source, collected in real time within the system. Furthermore, the AI module will feature a continuously evolving and learning intelligent CHATBOT, supporting the work of any system operator, for example, by providing and suggesting ready-made solutions, procedures and analyses.

UNESCO World Heritage List,[177] historical monuments, museums, library archives, etc. In addition, the module will be developed with the ability to monitor and manage personnel and the transport of cultural goods, as well as generate and store dedicated reports, instructions, plans and procedures.

Moreover, the directions of development and improvement of SZK JAŚMIN will concern the expansion of the system with further functional modules, such as: a file repository module (file cloud),[178] After Action Review,[179] Mission Manage,[180] Simulation,[181] Report/plan generation module,[182] Data filtering tools,[183] MFW,[184] E-learning[185] and Language.[186]

Summary

This article examined the capabilities and future directions of the JAŚMIN Crisis Management System in the context of its use by bodies responsible for crisis management in Poland, whose functionalities take into account applicable legislation and other relevant documents, the classic crisis management model, all levels of command and management, contemporary security threats and the long-standing experience of the system's developers.

Furthermore, due to the system's modular structure, modern functionalities and extensive integration capabilities with other systems, the tool offers great flexibility

[177] United Nations Educational, Scientific and Cultural (UNESCO).

[178] The "built-in cloud/space" service will be designed for collecting, archiving and sharing all types of files (documents, illustrations and videos).

[179] The module will be designed to recreate the history of mobile units, rescuers, officers, the course of events, detected threats and phenomena, submitted reports and timeline reports.

[180] The module will function as an advanced manager for planning, managing and implementing missions, rescue operations and anti-crisis activities, taking into account any layers, areas, forces and resources, procedures and instructions.

[181] The module will enable the design and multiple reproduction of simulated variants of actions, situations, threats and the movement of units.

[182] This module is an advanced generator of freely configurable or template-based reports and plans. It can be exported to PDF, XLS and DOC files. The module contains operational data, metadata, raster layers and map layers stored in the system.

[183] This is an advanced functionality for filtering all operational data according to any criteria, e.g.: range areas, quantities, parameters, potentials and specialized data, etc.

[184] Offshore Wind Farms. This functionality is dedicated to operators managing and monitoring OWFs.

[185] This module includes tools, features and dedicated instructional materials, such as tutorials and guides, etc. that will enable operators and system users to quickly learn the system on their own.

[186] This is a tool that allows the changing of the interface language, e.g. ENG and others.

in use and enables support for operations not only in stationary conditions but, above all, in mobile mode.

In view of the above, and given that Poland has not adopted appropriate solutions to ensure an effective and reliable crisis management system, the author of this study recommends the implementation of a system for the whole country, designed for the planning, coordination and execution of tasks involving the Polish Armed Forces and the Civil Protection Unit[187] in combating natural disasters and mitigating their effects, in property protection operations, search and rescue operations, or in the protection of health and life in both military and non-military contexts.

This is a comprehensive, fully integrated solution which, through the automation of information exchange between all the services involved, has repeatedly accelerated key decision-making processes, streamlining planning, task setting and monitoring of implementation during crisis management operations.

As demonstrated by the most severe crises of recent years, the lack of decisiveness on the part of government bodies regarding the implementation of a crisis management system at the national level fails to resolve the persistent significant problems arising from an extensive

and constantly evolving catalogue of security threats in both non-military and military contexts. Above all, no lessons were learnt from the floods in south-western Poland in September 2024, where, in the initial phase, there was a lack of comprehensive analysis of the crisis situation and proper information flow,[188] which consequently contributed to fatalities and a delayed evacuation of the population.

The main goal of this study was to identify the current functional capabilities and determine key directions for the technological and organizational evolution of the Multi-Environment Automated Crisis Management System JASMINE (JASMINE CMS) in the context of contemporary hybrid and military threats.

The research question of this work was: How does the technological development and multi-environment architecture of the JASMINE CMS improve the effectiveness of crisis response and coordination between public administration services and the Polish Armed Forces?

The research methods used in this study allowed for the verification of the research hypothesis, which indicated that: the basis for the effective transformation of the national crisis management system is the implementation of universal multi--environment platforms such as the JASMINE CMS, and their modular expansion

[187] Układ Pozamilitarny (UPM).

[188] See M. Gurtowski et al., *Powódź 2024. Przebieg, konteksty, reagowanie kryzysowe i konkluzje*, Wydawnictwo Akademii Sztuki Wojennej, Warszawa 2024, pp. 31, 32.

and automated information flow significantly shortens response times and eliminates the barrier of communication inconsistency between civilian and military structures. The above hypothesis was confirmed to a significant extent through a detailed analysis of the system based on key functionalities and specialized modules, integration capabilities and the types of areas in which the system was/is used in the context of entities responsible for crisis management in Poland, both in the military and non-military spheres.

Bibliography

Abdul-Barikp A., Yussif F., Bipembi M.S., *Deployment of an Enhanced Web-based Really Simple Syndication (RSS) Aggregator*, "International Journal of Computer Applications" 2022, vol. 184, no. 23.

Albarqi A., Alzaid E., Al Ghamdi F., Asiri S., *Public Key Infrastructure: A Survey*, "Journal of Information Security" 2015, vol. 6, no. 1.

Alo U.R., Firday N.H., *Voice over Internet Protocol (VOIP): Overview, Direction And Challenges*, "Journal of Information Engineering and Applications" 2013, vol. 3, no. 4.

APP-6A. Military Symbols for Land Based System, Brussels 1998.

Bakare B.I., Abidde W.N., *A Technical Review of Long Term Evolution (LTE) Operations*, "American Journal of Engineering Research" 2022, vol. 11, iss. 4.

Banerjee S., Makwana R.R.S., *Virtual Private Network: Survey and Research Challenges*, "International Journal of Latest Technology in Engineering, Management & Applied Science" 2025, vol. 14, iss. 6.

Barker E., Dang Q., Frankel S., Scarfone K., *Guide to IPsec VPNs*, National Institute of Standards and Technology, Gaithersburg 2020.

Blechman Ł., *System Zarządzania Kryzysowego Jaśmin. Materiały źródłowe firmy TEDAT*, Bydgoszcz 2025.

Curran K., Crumlish J., Fisher G., *OpenStreetMap*, "International Journal of Interactive Communication Systems and Technologies" 2016, no. 2(1).

Dahmann J.S., Fujimoto R.M., *The Department of Defense High Level Architecture*, Proceedings of the 29th conference on Winter simulation (WSC '97).

Department of Defense Dictionary of Military and Associated Terms, December 2003.

Doktryna współpracy cywilno-wojskowej Sił Zbrojnych RP DD/9, MON, Warszawa 2004.

Gerzp M., *Multilateral Interoperability Programme MIP Test Reference System*, Fraunhofer Institute for Communication, Information Processing, and Ergonomics, Wachtberg 2009.

Gurtowski M., Janik K., Kęsoń T., Kogut B., Mróz A., Zagórska A., *Powódź 2024. Przebieg, konteksty, reagowanie kryzysowe i konkluzje*, Wydawnictwo Akademii Sztuki Wojennej, Warszawa 2024.

Izdebski W., *Implementacja GML w praktyce*, Politechnika Warszawska, Geo-system Sp. z o.o, Warszawa 2013.

Izdebski W, Seremets A., *Praktyczne aspekty infrastruktury danych przestrzennych w Polsce. Część II*, Główny Urząd Geodezji i Kartografii, Warszawa 2021.

Griffin R.W., *Podstawy zarządzania organizacjami*, Wydawnictwo Naukowe PWN, Warszawa 2005.

Ignatenko V., Laurila P., Radius A., Lamentowski L., Antropov O., Muff D., *ICEYE Microsatellite SAR Constellation Status Update: Evaluation of First Commercial Imaging Modes*, IGARSS 2020 – 2020 IEEE International Geoscience and Remote Sensing Symposium, Espoo, Finland 2020.

Jękot R., *Ujęcie problematyki ochrony przeciwpowodziowej w Krajowym Planie Zarządzania Kryzysowego 2021/2022*, "Securo" 2024, no. 11.

Kęsy M., *Informacja i systemy informacyjne w działalności gospodarczej*, "Dydaktyka Informatyki" 2011, vol. 6.

Krstićp I., *Network Centric – the new weapon of the information age*, "Obronność. Zeszyty Naukowe" 2016, no. 3(19).

Kuraś M., *System informacyjny – system informatyczny. Co poza nazwą różni te dwa obiekty?*, "Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie" 2009, no. 770.

McCown G.E., *The Over-the-Horizon Targeting (OTH-T)*, Program and the Reconfigurable Land-Based Test Site (RLBTS) Laboratory, SSC San Diego 2021.

McNeff J.G., *The Global Positioning System*, "IEEE Transactions on Microwave Theory and Techniques" 2002, vol. 50, no. 3.

Morowczynski M., Epping M., *Authentication and Authorization*, IDPro Body of Knowledge, Wakefield 2021.

Nepelski M., *Zarządzanie w sytuacjach kryzysowych*, Wydawnictwo Wyższej Szkoły Policji w Szczytnie, Szczytno 2016.

Nowak E., *Zarządzanie kryzysowe w sytuacjach zagrożeń niemilitarnych*, Wydawnictwo AON, Warszawa 2007.

Ogbulezie J.C., Akonjom N.A., Ojomu A., Ezugwu A.O., *The Bane of Public Switch Telephone Network (PSTN) in Nigeria*, "International Journal of Research in Engineering and Science", vol. 4, issue 7.

Orzoł A., *The implementation of Link 16 in the Polish Armed Forces and its influence on defence capabilities, national security and image of Poland as a NATO member*, "Studia Bezpieczeństwa Narodowego" 2015, vol. 7, no. 1.

Palka R., *Koncepcja rozwoju Systemu Wspomagania Dowodzenia HMS C3IS JAŚMIN Wojsk Lądowych w działaniach sojuszniczych i koalicyjnych* [doctoral dissertation], Akademia Kaliska, Kalisz 2023.

Pietrek G., *Poziomy, struktura i zadania systemu zarządzania kryzysowego administracji rządowej*, "Zeszyty Naukowe WSOWL" 2011, no. 3(161).

Piwowarski J., *System zarządzania kryzysowego w Polsce, Wybrane aspekty*, Naukowo-Wydawniczy Instytut Badań Bezpieczeństwa i Obronności WSBPI „Apeiron" w Krakowie, Kraków–Katowice 2018.

Polito G., Ducasse S., Tesone P., Brunziep T., *Unified FFI – Calling Foreign Functions from Pharo*, Square Bracket Associates, Lille 2020.

Sasikiran N., Rao N.G., Teja N.R., Kumar J.K., *Global System For Mobile Communication (GSM)*, "International Journal of Scientific Research and Management", vol. 3, iss. 4.

Senczyk D., *Zintegrowane systemy zarządzania w przedsiębiorstwie na wybranych przykładach*, "Przegląd Naukowo-Metodyczny" 2014, no. 7, iss. 1.

Sindu P., Khan A.R., *Cybersecurity to Protecting Source Code*, Gannon University, Erie 2023.

Słownik terminów z zakresu bezpieczeństwa narodowego, Wydawnictwo Akademii Obrony Narodowej, Warszawa 2008.

Schmickley D.L., *Night Vision Goggles*, Spitzerap C.R. (ed.), *The Avionics Handbook*, Washington 2021.

Sobolewski G., *Siły Zbrojne RP w zarządzaniu kryzysowym. Aspekt narodowy i międzynarodowy*, Wydawnictwo Akademii Obrony Narodowej, Warszawa 2013.

Szaniawska A., Grochowska A., *System informacyjny w zarządzaniu współczesną organizacją*, "Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach" 2014, no. 103.

Szot L., Świec M., *Klęski żywiołowe jako przesłanki sytuacji kryzysowych*, "Zeszyty Naukowe Państwowej Wyższej Szkoły Techniczno-Ekonomicznej im. ks. Bronisława Markiewicza w Jarosławiu. Współczesne problemy zarządzania" 2017, no. 10.

Walrand J., Parekh S., *Communication Networks. A Concise Introduction*, The University of California, Berkeley 2018.

Wołejszo J., Biernacik B., *Możliwości zastosowania platformy Jaśmin w systemie zarządzania transportem szynowym*, "Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników w Krakowie" 2014, no. 2(104).

Woźniak K., *Charakterystyka źródeł informacji*, in: M. Ćwiklicki (ed.), *Wprowadzenie do analizy wartości informacji*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2015.

Wróblewski D., *Wybrane zagadnienia z zakresu planowania cywilnego w systemie zarządzania kryzysowego RP*, Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej im. Józefa Tuliszkowskiego, Państwowy Instytut Badawczy, Józefów 2014.

Zywicki J., Prochnow D.L., Schumaker M.R., Bhatti A.S., *Expanding the Reach of Distributed Interactive Simulation (DIS) to Service Based Modeling and Simulation Environments*, Fall Simulation Interoperability Workshop 2011.

Act of 26 April 2007 on crisis management, Dz.U. (Journal of Laws) 2023, item 122.

Act of 29 November 2000 – Atomic Law, Dz.U. (Journal of Laws) 2024, item 1277.

Act of 18 July 2002 on the provision of services by electronic means, Dz.U. (Journal of Laws) 2024, item 1513.

Act of 17 May 1989, Geodetic and Cartographic Law, Dz.U. (Journal of Laws) 2024, item 1151.

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information in the European Community (INSPIRE – Infrastructure for Spatial Information in Europe), OJ L 108, 25.4.2007, pp. 1–14.

Order No. 12 of the Police Commander-in-Chief of 19 May 2020 on the Police Command Support System, Dz.U. (Journal of Laws) 2020, item 23.

Ávila M.A., *Automatic Dependent Surveillance – Broadcast (ADS-B)*, s. 6, https://www.icao.int/NACC/Documents/Meetings/2023/ECARNTG12/ECARNTG12-P-2.pdf, (accessed 19.06.2025).

Bayraktar TB2, Baykar, https://baykartech.com/en/uav/bayraktar-tb2/, (accessed 16.06.2025).

Bray D.A., *Delivering on the Vision of Multi-Domain Command and Control*, www.businessofgovernment.org, (accessed 17.06.2025).

CivTAK / ATAK, Civilian, News, Licensing, Support & Download for ATAK / TAK Tools and Plugins https://www.civtak.org/category/plugins/, (accessed 15.06.2025).

Co to jest Licencjonowanie opro…, Ardura Consulting, https://ardura.pl/slownik/licencjonowanie-oprogramowania/, (accessed 15.06.2025).

Dark, Mapbox https://www.mapbox.com/maps/dark, (accessed 16.06.2025).

DART – system zarządzania bezpieczeństwem publicznym, Sprint, https://sprint.pl/pl/uslugi/system-zarzadzania-bezpieczenstwem-publicznym-dart, (accessed 15.06.2025).

Drony DJI, Flystore, https://flystore.pl/Drony-DJI, (accessed 16.06.2025).

Entry *system informatyczny*, Encyklopedia PWN, https://encyklopedia.pwn.pl/haslo/system-informatyczny.html, (accessed 4.06.2025).

Entry *wideokonferencja*, Wikipedia, https://pl.wikipedia.org/wiki/Wideokonferencja, (accessed 13.06.2025).

ETC-PZL Aerospace Industries – Nowoczesne symulatory o unikalnych konfiguracjach i możliwościach treningowych, ZBiAM – Zespół Badań i Analiz Militarnych, https://zbiam.pl/etc-pzl-aerospace-industries-nowoczesne-symulatory-o-unikalnych-konfiguracjach-i-mozliwosciach-treningowych/, (accessed 5.06.2025).

Friendly force tracking (FFT), BENEFITS.COM, https://benefits.com/glossary/friendly-force-tracking-fft/, (accessed 16.06.2025).

Fly Eye Uncrewed Aerial System (UAS), Poland, Army Technology, https://www.army-technology.com/projects/fly-eye-unmanned-aerial-vehicle/, (accessed 16.06.2025).

Format GeoTIFF, DATAGIS.PL, https://www.datagis.pl/strona/geotiff, (accessed 19.06.2025).

Frequency Bands: The differences between HF, UHF and VHF, SMC Group, https://smcgroupglobal.com/frequency-bands/, (accessed 12.06.2025).

Geoportal.gov.pl , https://www.geoportal.gov.pl/pl/usluga/uslugi-pobierania-wfs/, (accessed 12.06.2025).

Heikkilä T., *CDMA – Code Division Multiple Access*, http://www.comlab.hut.fi/opetus/333/2004_2005_slides/ CDMA_text.pdf, (accessed 12.06.2025).

Informacje o programie Copernicus, Copernicus, https://www.copernicus.eu/pl/informacje-o-programie-copernicus, (accessed 16.06.2025).

ISOK chroni kraj, ISOK, https://www.gispartner.pl/pf/isok/, (accessed 16.06.2025).

Jesuthasan M., *What is Business Relationship Management and How Can it Help Your Organization?*, Business Relationship Management Institute, https://brm.institute/what-is-business-relationship-management-how-does-it-help, (accessed 12.06.2025).

KE ostrzegała przed powodziami. Dane pochodziły z satelitów, Space 24, https://space24.pl/satelity/obserwacja-ziemi/ke-ostrzegala-przed-powodziami-dane-pochodzily-z-satelitow, (accessed 5.06.2025).

KML – Keyhole Markup Language, https://gdal.org/en/stable/drivers/vector/kml.html, (accessed 19.06.2025).

KMZ (Keyhole Markup Language Zipped), GISBOX, https://itigic.com/pl/kmz-file-what-is-it-how-to-create-open-and-edit-in-windows/, (accessed 19.06.2025).

Konwerter Współrzędnych GPS, MyLocationMap.com, https://mylocationmap.com/pl/gps-coordinates-converter/, (accessed 16.06.2025).

Krajowe Centrum Monitorowania Ratownictwa Medycznego, *System Wspomagania Dowodzenia Państwowego Ratownictwa Medycznego (SWD PRM)*, https://www.kcmrm.pl/swdprm/, (accessed 15.06.2025).

Kręcikij J., *Wielodomenowy HMS C3IS JAŚMIN*, https://zbiam.pl/wielodomenowy-hms-c3is-jasmin/, (accessed 12.06.2025).

Laygude Y., *What Is Authorization? Definition, Process, and Examples*, Tech Prescient, https://www.techprescient.com/blogs/authorization/, (accessed 15.06.2025).

Ministerstwo Spraw Wewnętrznych i Administracji, *Regionalny System Ostrzegania*, https://www.gov.pl/web/mswia/regionalny-system-ostrzegania, (accessed 15.06.2025).

MGRS, UTM and WGS84 Coordinate Grid on a Map, MAP. ARMY https://www.map.army/doc/en/map/coordinategrid/, (accessed 16.06.2025).

Modeling and Simulation, SPRINGER NATURE, https://link.springer.com/book/, (accessed 19.06.2025).

Murphey D., *Wprowadzenie do Webex Events RTMP Player*, Webex Events Academy, https://help.socio.events/pl/articles/4348408-wprowadzenie-do-webex-events-rtmp-playerio.events, (accessed 14.06.2025).

Open Geospacial Consortium, https://www.ogc.org/standards/wms/, (accessed 12.06.2025)

Optical Network Terminal & ODN Explained, TTIFiber, https://ro.uow.edu.au/articles/thesis/, (accessed 19.06.2025).

Ortofotomapa (ORTO), geoportal.gov.pl, https://www.geoportal.gov.pl/pl/dane/ortofotomapa-orto/, (accessed 16.06.2025).

Państwowa Akademia Nauk Stosowanych w Chełmie, *Wielośrodowiskowy Zautomatyzowany System Zarządzania Kryzysowego JAŚMIN w PANS w Chełmie*, https://panschelm.edu.pl/wielosrodowiskowy-zautomatyzowany-system-zarzadzania-kryzysowego-jasmin-w-pans-w-chelmieinnowacyjny-system-na-potrzeby-laboratorium-zarzadzania-kryzysowego-dla-pans-w-chelmie/, (accessed 16.05.2025).

Polsa, *Narodowy System Informacji Satelitarnej*, https://polsa.gov.pl/aktywnosci/obserwacja-ziemi/nsis/, (accessed 16.06.2025).

Praktyczny przewodnik, Drony Dla Firmy, https://dronydlafirmy.pl/dronetower-i-inne-narzedzia/, (accessed 19.06.2025).

Radar statków – Śledzenie statków, skyradar.pl, https://www.skyradar.pl/p/ruch-statkow-sledzenie-na-morzu.html, (accessed 17.06.2025).

Sabak J., *System JAŚMIN też w zarządzaniu kryzysowym i wsparciu akcji antykryzysowych*, https://defence24.pl/polityka-obronna/system-jasmin-tez-w-zarzadzaniu-kryzysowym-i-wsparciu-akcji antykryzysowych, (accessed 16.05.2025).

SIRON – wspierając poszukiwania, https://poszukiwania.org/, (accessed 15.06.2025).

Skavish K., *Kompletny przewodnik po RTMP: co to jest i kiedy go używać?*, https://wave.video/pl/blog/rtmp-guide/.

SZK JAŚMIN – Wielośrodowiskowy Zautomatyzowany System Zarządzania Kryzysowego, https://www.teldat.com.pl/oferta/produkty/systemy/319-szk-jasmin.html, (accessed 5.06.2025).

Spełnienie wymogów jakości powietrza jest możliwe, airly, https://airly.org/pl/o-airly/, (accessed 19.06.2025).

SWD-ST. System Wspomagania Decyzji Państwowej Straży Pożarnej, Abacus, https://abakus.net.pl/oferta/swd-st, (accessed 15.06.2025).

System Informacji Przestrzennej Administracji Morskiej, SIPAM, https://sipam.gov.pl/, (accessed 16.06.2025).

System SEIS – Secure Exchange Information System, TELDAT https://www.teldat.com.pl/oferta/produkty/systemy/101-sbwi-saron.html, (accessed 15.06.2025).

Variable Message Format (VMF), GlobalSpec, https://standards.globalspec.com/std/14636365/app-06, (accessed 12.06.2025).

Warsztaty z zarządzania kryzysowego w operacji FENIKS, https://www.polska-zbrojna.pl/home/articleshow/, (accessed 15.05.2025).

Windy: radar pogodowy online. Jak korzystać z aplikacji Windy?, SUPERexpress, https://pogoda.se.pl/windy-aplikacja-z-radarem-pogodowym, (accessed 19.06.2025).

QGIS – poradniki, instrukcje, Portable info PL, https://portable.info.pl/qgis-poradniki-instrukcje/, (accessed 15.06.2025).

TAK dla bezpieczeństwa Polski, Wydawnictwo AVT, https://elportal.pl/blog/ciekawostki/7540-tak-dla-bezpieczenstwa-polski, (accessed 19.06.2025).

Traffic, emapa, https://opis.emapi.pl/obsluga-emapi/traffic/, (accessed 19.06.2025).

3 podstawowe narzędzia cyfrowe dla pilotów i operatorów dronów od PAŻP i ULC. Praktyczny przewodnik, Drony Dla Firmy, https://dronydlafirmy.pl/dronetower-i-inne-narzedzia, (accessed 19.06.2025).

UTM Zone Finder: What UTM Zone Are You In?, MAPSCAPING, https://mapscaping.com/utm-zone-finder, (accessed 16.06.2025).

What Does COMMS Stand For? All COMMS Meanings Explained, ALLACRONYMS, https://www.allacronyms.com/COMMS/Communications, (accessed 17.06.2025).

What is a GeoJSON file, FILEFORMAT, https://docs.fileformat.com/gis/geojson/, (accessed 19.06.2025).

World Geodetic System 1984 (WGS 84), Office of Geomatics, https://earth-info.nga.mil/index.phpdirwgs84actionwgs84, (accessed 16.06.2025).

XMPP Protocol, GeeksforGeeks, https://www.geeksforgeeks.org/html/xmpp-protocol/, (accessed 19.06.2025).

Summary

The subject of this article concerns the possibilities and directions of development of the JASMINE CMS in the context of its use by entities responsible for crisis management in Poland, whose functionalities take into account the applicable legal acts and other documents in the subject area, the classic crisis management model, all levels of command and management, contemporary security threats and many years of experience of the system's creators.

In addition, due to the modular structure of the system and modern functionalities as well as wide integration possibilities with other systems, the tool provides great flexibility in use and also allows for support of activities not only in stationary conditions, but above all in mobile mode. This is a comprehensive, fully integrated solution which, through the ability to automate the exchange of information between all involved services, has repeatedly allowed the acceleration of key decision-making processes, streamlining planning, setting tasks and controlling their implementation during the implementation of crisis management tasks.