Applied problems of information systems operation

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ADVANCED INFORMATION TECHNOLOGIES (C4ISR) IN THE PEACEKEEPING FIELD SERVICE

Abstract. Using and developing advanced information technologies are significant in the peacekeeping field service, as it could positively affect on mission implementation, decision-making, and even save lives. **The purpose of the research** is to analyze progressive field mission information technologies used in peace and security operations. **Methods:** the study is based on the use of empirical scientific methods of observation and study, based on the experience of personal participation in a UN peacekeeping mission, as well as general scientific methods, methods of OSINT analysis, etc. **The tasks of the study** are to analyze and summarize the main advanced technological solutions implemented in the activities of UN field peacekeeping missions in the area of C4ISR (the concept of command, control, communications, computers, intelligence, surveillance and reconnaissance). **Results of the research** indicate that peacekeeping missions differ from combat missions in the way they are conducted. The principle of protection, communication and reconnaissance is not the same; the integrated use of a variety of technologies has created a state-of-the-art information management system for UN peacekeeping operations. **Conclusions:** this study contributes to the peacekeeping field, information technologies sphere, by providing valuable information based on the personal practical experience, thereby aiding researchers and practitioners in selecting the most suitable tools for of command, control, communications, computers, intelligence, surveillance, and reconnaissance during peacekeeping mission. The information in the paper may be used to guide the planning and organization of communication and informatization systems in operations and missions of both as for multinational and as for homogeneous force units.

Keywords: information technology; telecommunication, signal communication; peacekeeping; C4ISR.

Introduction

General problem statement. In June 2014, the UN under-secretaries general for peacekeeping operations and field support appointed an Expert Panel on Technology and Innovation in UN Peacekeeping to analyze how peacekeepers can more effectively utilize technological innovations, including Internet-enabled technologies. In February 2015, the UN issued the Expert Panel's report, which included the goal that the UN be able to deploy "digital peacekeepers" [1].

Since the identification of the need for "digital peacekeepers" as means of modernizing peacekeeping, the issue has progressed. Various programs for improving information and communications technology have been created, several courses and training have been introduced, many symposiums and seminars have been held, standards and other documents have been issued, and, most importantly, many projects and technological solutions have been proposed/implemented. Let us explore main of them.

Analysis of recent research and publications in the relevant field. After analyzing the contemporary works where have been studied the problem of using information technologies in the peacekeeping missions, we can emphasize the following. First of all, "Final Report of the Expert Panel on Technology and Innovation in Peacekeeping: Performance Peacekeeping" [2]. This report argues for much wider deployment of technology and innovative practices to help strengthen peacekeeping and, in so doing, seeks to dispel some of the more pervasive myths that have impeded progress toward this aim. The report focuses the bulk of its discussion on the realities of operating in the field and makes a number of recommendations regarding technology to adapt now to aid peacekeeping staff and forces in fulfilling their mandates.

The work "Enhancing the use of digital technology for integrated situational awareness and peacekeeping-intelligence" [3] was prepared by Dirk Druet of the McGill University Centre for International Peace and Security Studies for the UN Department of Peace Operations as an input for the preparation of a new strategy for Technology in UN Peacekeeping Operations. This paper is devoted surveying the state of digital technologies in use for peacekeeping-intelligence and situational awareness, describing in broad terms their purposes, capabilities and operational contexts, and considering what impact these have had on peacekeeping-intelligence and situational awareness, both individually and collectively.

The UN "Peacekeeping-Intelligence, Surveillance and Reconnaissance Staff Handbook" [4] (PKISR) represents an evolution in peacekeeping-intelligence in UN Missions. This staff handbook builds on the UN Military Peacekeeping-Intelligence (MPKI) Handbook and is designed primarily to assist staff deployed in military peacekeeping-intelligence roles in UN peacekeeping operations at the Force and Sector levels. But beyond, all elements of the Mission, both uniformed and civilian, should have the ability to make use of the PKISR capabilities within the Mission to have their peacekeeping-

intelligence questions answered. This staff handbook therefore supports those not directly involved in the management of PKISR in understanding how to do this.

The article of Esberg J. and Mikulaschek C. "Digital technologies, peace and security: challenges and opportunities for United Nations Peace Operations" [5] provides an overview of both challenges and opportunities for contemporary UN peace operations resulting from digital technologies. This paper touches on a number of areas – including social media, cell phones, unmanned aerial vehicles, and artificial intelligence – that currently complicate prospects for peace in conflict environments, or that are likely to do so in the near future. Examines opportunities for UN peace operations to leverage digital technologies – including social media, cell phones, satellite imaging, unmanned aerial vehicles, closed-circuit television, and artificial intelligence – to deliver on their mandates to promote and maintain peace.

The article "New Technologies and the Protection of Civilians in UN Peace Operations" [6] by A. Sarfati provides a fresh perspective on the connection between digital transformation, new technologies, peacekeeping and the protection of civilians. The author identifies the problem that, the Department of Peace Operations deploys new technological tools first and only then determines how to apply them to the protection of civilians objectives. In this article have been analyzed such platforms like SAGE and Unite Aware can help missions analyze data on threats and violence against civilians. Intelligence, surveillance, and reconnaissance tools like satellite imagery and unarmed aerial vehicles can aid in the collection of such data. The monitoring of communication platforms can also provide contextual information and insight into trends in public opinion, giving clues about future waves of violence.

At the same time, given the relevance and importance of the use of information technologies in peacekeeping missions, this topic remains under-researched and requires analysis and search for rational solutions to improve the use of information technologies in the peacekeeping field service.

Statement of the article tasks. The purpose of the publication is the formation of proposals for the implementation of a complex of specific field information technologies and technical solutions, which could become a certain manual for the deployment of a multinational connection with a defined area of responsibility in peacekeeping activities.

Advanced field technical solutions and projects

Radio communication. In UN missions to provide radio communication for various areas of activity widely used radio equipment of well-known manufacturers, such as CODAN, BARRET, JOTRON, MOTOROLLA and others.

The CODAN Company offers its customers a wide range of technologies and technical solutions for the organization of an information exchange system for specific tasks and conditions.

The official site of the company [7] provides information on what specific solutions CODAN can offer the UN to ensure peacekeeping activities (Fig. 1).

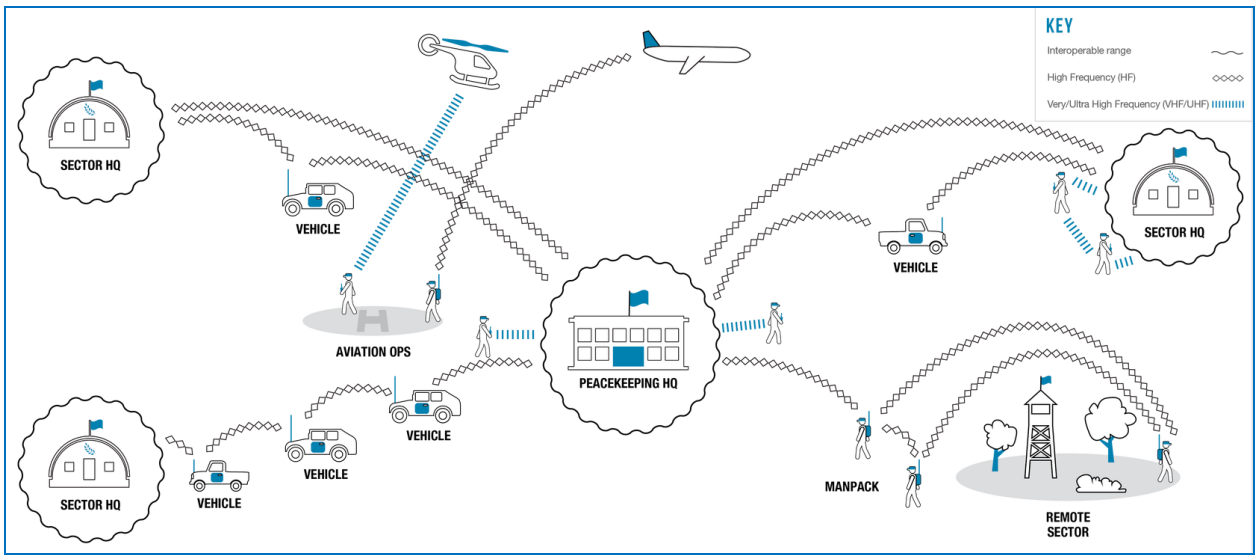

Fig. 1. Fully integrated communication solution by CODAN [7]

In practice, communication and information exchange systems in UN missions include technical solutions and tools from various companies.

One of such solutions is High Frequency (HF) Assure Technology, it is widely used in UN missions. Codan Communications developed HF Assure Technology in July 2014 as its 2nd Generation Digital Voice solution as more affordable, encrypted (optional), clear, and "better than analogue" performance with their Envoy™ series of Software Defined Radios (SDRs). The paper [8] introduces HF Assure, issues how it can help the UN communicate (for example the UN in Mali) and how to design and deploy reliable HF communications resolving the challenge with skip zone.

What is the HF Assure solution? HF Assure is a voting system that represents the evolution of long-distance HF communications: from legacy signaling to the most advanced digital technologies for voice,

message and data transmission. The system offers an easy-to-use, multilingual user interface, integrating encryption capabilities, smartphone application management, Internet Protocol (IP) and Ethernet connectivity, and advanced HF communication capabilities. HF Assure systems can have up to four radios interconnected via IP. We may say, that this is forms the basis of a voting style system.

When trying to communicate with radio stations in a skip zone, you may encounter some difficulties. A skip zone (also known as a silent zone or a quiet zone) is an area where radio transmissions are poorly received. The skip zone is located between regions both closer and further from the transmitter where reception is possible (Fig. 2).

During typical UN operations, the mobile units depart from their base locations and report their movements using either Very High Frequency (VHF) or Ultra High Frequency (UHF) radio networks up to approximately 20 to 30 km (depending on repeater infrastructure, radio power, and the terrain).

Once beyond the VHF/ UHF coverage area, communications become difficult or unworkable. In most cases, communication becomes complicated or fails because the mobile is trying to communicate within the skip zone. The industry-standard method to reduce the skip zone is to install NVIS (Near-Vertical Incidence Skywave) antennas on mobile vehicles.

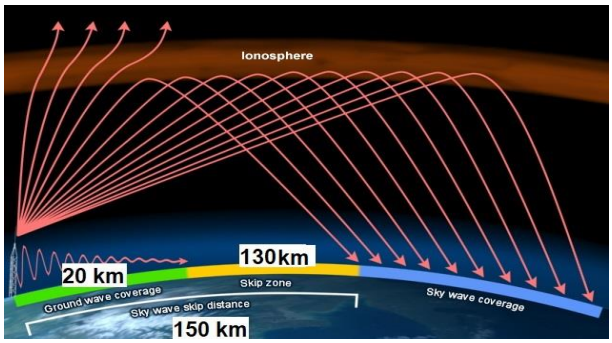

Fig. 2. Skip Zone with ground and sky wave

While this configuration improves the performance within the skip zone, it does not completely remove the skip zone or guarantee communications. Codan's HF Assure technology will help defeat the skip zone and provide communications from 0 to 500 km [8].

It is possible to learn more about the theory of NVIS, for example, at the presentation in the source [9].

Another interesting CODAN solution, which founds its use in the UN, is the Radio Interoperability System (RIOS) (Fig. 3).

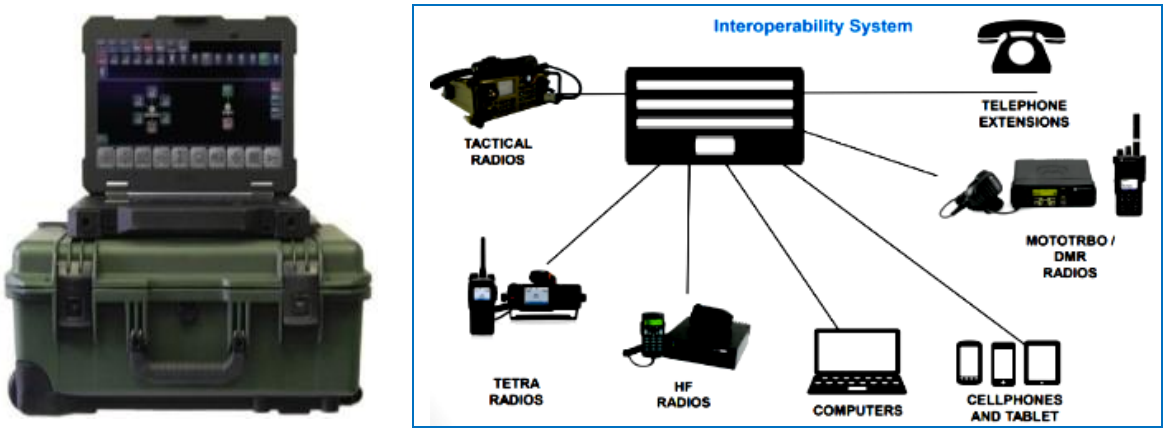

Fig. 3. Codan RIOS (Radio Interoperability System) [7]

The RIOS is the solution for cross-banding, traditionally non-compatible multi-vendor radio such as high frequency (HF), very high-frequency (VHF) and ultrahigh-frequency (UHF) legacy and new technologies, cellular and satellite networks, IP addressable assets either locally, from remote locations or multi-site locations [10].

RIOS provides interoperability between a range of communications devices including radios, smartphones, and computers, enabling a fully integrated communications network from anywhere in the world.

Satellite communication. Peacekeeping efforts involve the coordination and collaboration of civilian and military organizations that depend exclusively on information exchange for rapid response and operational readiness. The use of wireless as a necessary communication requirement will aid in the achievement of these objectives.

Fundamental work on the analysis of wireless and satellite technology is found here [11]. This work, though dated (2001), provides a thorough account of the theory of the organization of satellite communication in the interests of peacekeeping.

The most common data service for broadband applications is the VSAT (a very small aperture terminal). A VSAT is a device (also known as an earth station) that is used to receive satellite transmissions. The "very small" component of the VSAT acronym refers to the size of the VSAT devices (Fig. 4).

The Satcube Ku is a reference portable satellite terminal that enables broadband connectivity almost anywhere in the world.

The innovative Satcube Ku terminal (Fig. 5) is a compact, user-friendly device offering fast connectivity for employees to communicate and deliver essential services.

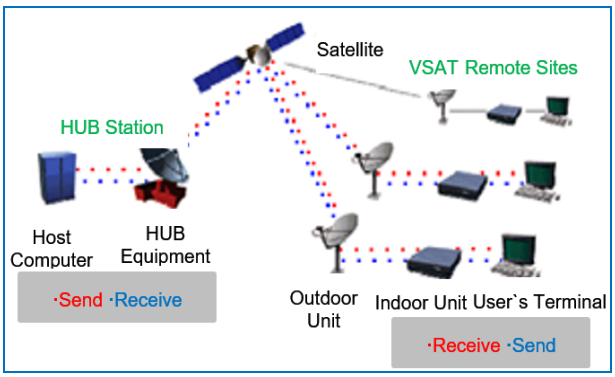

Fig. 4. VSAT Network (Star Topology) [11]

Fig. 5. SATCUBE VSAT terminal [12]

The highly intuitive user interface allows for extremely simple use, easily accessible to all. It can be commissioned in less than a minute.

Main advantages of SATCUBE VSAT:

- lightweight – is only 8 kg. All-in-one compact carry-on satellite terminal with a flat antenna the size of a large laptop;
- high speed – up to 20 Mbps. Tapping next-generation High Throughput Satellites (HTS) and wide-beam Ku;
- allows for connection within under a minute;
- easy to use – a highly intuitive user interface makes operation as simple as using a smartphone;
- wide coverage area (Fig. 6).

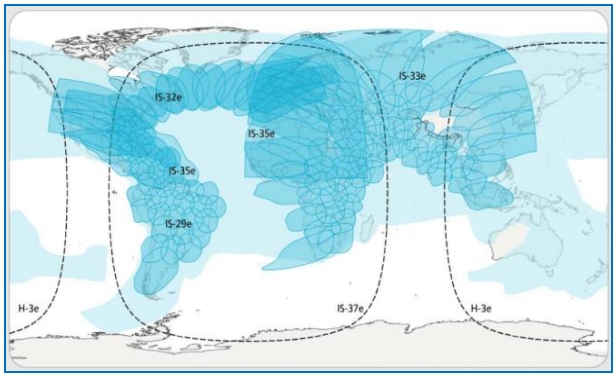

Fig. 6. Coverage network map SATCUBE VSAT [12]

The means of the world-famous company are widely used in peacekeeping and security operations Iridium is known for its portability and user-friendly interface. The line of technological solutions (products and services) providing satellite communication is presented on the company's official website [12].

The company claims that Iridium's unique constellation architecture "makes it the only network that covers 100% of the planet. Satellites are cross-linked to provide reliable, low-latency, weather-resilient connections that enable communication anywhere in the world. The unique Iridium constellation of 66 Low Earth Orbiting (LEO) cross-linked satellites routes communications traffic through space and around the world, creating highly efficient and reliable connections" [13]. In 2019 Iridium completed an upgrade to the iridium constellation, replacing all satellites without ever disrupting service.

An interesting solution of this company from the point of view of the military is the service Netted Iridium. It is Distributed Tactical Communication System. It was made for the U.S. Government and eligible for the Iridium-EMSS Contract through U.S. Space Force & Commercial Satellite Communications Office.

As stated on Iridium's website, with its unique broadcast capability, Netted Iridium's Distributed Tactical Communication System provides a robust, tactical, low-latency, push-to-talk solution. It is broadcast to an unlimited number of users over a single secure channel and takes advantage of netted real-time voice and data services.

To implement this solution, you can use the end devices of the company's production Iridium and production of the company L3 Harris (Fig. 7), which is an interesting example of cooperation between two companies to achieve the same goal.

Fig. 7. Iridium and L3 Harris end devices for use in Iridium Tactical Communication System [13]

Main features:

- Secure channel available through a dedicated U.S. Government gateway.
- Interoperability with terrestrial networks and equipment.
- Truly Global. Supports over-the-horizon and on-the-move tactical operations.
- Simultaneous voice and data communications on a single secure channel.
- Real-time situational awareness with the ability to transmit Position Location Information (PLI).
- Group Communications. Ability to broadcast to unlimited users.
- Over-the-Air Updates. Supports net broadcast configuration, maintenance, and control from anywhere in the world.

GPS tracking systems All issues, such as the need for tracking, technical requirements, cost, personal privacy, a survey of tracking solutions, and the politics of positioning are impressively outlined in the article "Blue Mission Tracking: Real-Time Location of UN Peacekeepers" [14].

Geographic Information Assistant (GINA) is presented in the Fig. 8. Dispatchers and commanders need to have real-time visibility of their positions and combine it with critical data sets for instant reaction and well-informed decisions [15].

GINA System is a map software technology for computers, tablets, and mobile devices, which enable its users to navigate through difficult terrain, coordinate teams, and exchange information effectively. It runs on the hardware of Motorola Company, which has a sturdy design for work in the field and is perfectly adjusted to the needs of field workers.

Fig. 8. Geographic Information Assistant (GINA) system [16]

GINA System consists of components:

- GINA Central – Command & control tool based on a live collaborative map with instant updates.
- Personnel & vehicle tracking – Tracking hardware which can be handheld or mounted in the cars.
- GINA GO – Location tracking app for increasing your safety & field data collection.

Intelligence, Surveillance and Reconnaissance. The first edition of the UN Military Peacekeeping-Intelligence Handbook (UN MPKI HB) was published in 2019 [17], and in September 2020 first edition Peacekeeping-Intelligence, Surveillance and Reconnaissance Staff Handbook was approved and published (PKISR HB) [18]. These two books are essential manuals on organization and provision ISR.

According to this Handbook, there are Peacekeeping-Intelligence Disciplines:

- Human Peacekeeping-Intelligence (HPKI);
- Open-Source Peacekeeping-Intelligence (OPKI).
- Signals Peacekeeping-Intelligence (SPKI);
- Geospatial Peacekeeping-Intelligence (GPKI).

Human Intelligence (HUMINT) concerns information that is elicited or otherwise provided by human sources. In this discipline, digital information technologies are not very widely used due to the specifics, but in others: Signals Peacekeeping-Intelligence (SPKI), Open-Source Peacekeeping-Intelligence (OPKI), Geospatial Peacekeeping-Intelligence (GPKI) quite actively, sometimes, it is even the basis on which the essence of the corresponding type of intelligence is built [19].

Open-Source Peacekeeping-Intelligence (OSINT) use information obtained from sources accessible to the public, such as radio, television, the Internet, press, and other unclassified information. OSINT is to be used as a platform for the monitoring of actors' use of different media.

Within the OSINT framework, big data analytics, and artificial intelligence technologies can be used to process large volumes of information received from radio exchange. In particular, the Radio Mining Project in MINUSMA (United Nations Multidimensional Integrated Stabilization Mission in Mali) provides for the automatic translation of voice information into text (see Fig. 9), in which the artificial intelligence based on keywords can highlight what the operator needs, which is also used in OSINT [20].

Fig. 9. Data scientist in Pulse Lab Kampala working on speech-to-text technologies for indigenous languages [20]

Signals Peacekeeping-Intelligence (SPKI). SIGINT is the generic term for SPKI derived information from the electromagnetic spectrum. It includes COMINT and ELINT. SIGINT is based on the interception, location, analysis, and monitoring of radio communications (COMINT) and the interception and analysis or electronic measurement of other radio transmissions such as radar signals (ELINT), to obtain information on the transmitter and its users. By combining information obtained in these ways and others it is possible to identify targets with the accuracy needed for precision weapons as well as to predict the enemy's intentions.

There is not much information in open sources about the means used in the direction of Signals intelligence, as this information is sensitive or classified. According to [21] signal intelligence unit has been considered for deployment in MONUSCO since the Force Intervention Brigade was mandated with the offensive task of "neutralizing armed groups" in eastern Democratic Republic of the Congo. Journalistic

reporting suggests that the digital technologies deployed with the unit consist of international mobile subscriber identity (IMSI) catcher technology, the first time such a tool has been officially deployed in a peacekeeping operation (Fig. 10).

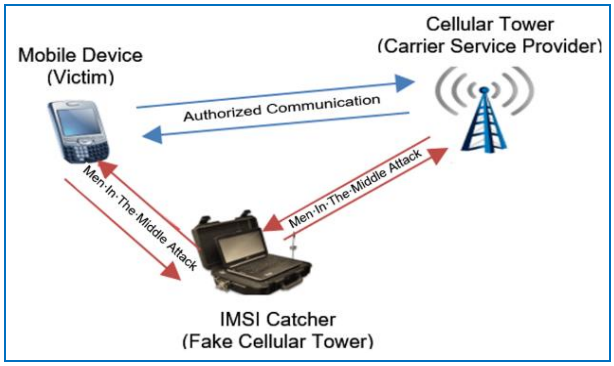

Fig. 10. Principle of International Mobile Subscriber Identity (IMSI) catcher work [21]

If in the area of responsibility/mission, the conflicting parties will use protection against disclosure of signals based on technologies of encryption, scrambling, or even the use of crypto primitives, then it will be more difficult, or even impossible, for the forces of peacekeeping operations to use this type of intelligence. The same applies to the principles of organizing radio exchanges between peacekeeping forces. It is not recommended to neglect communication security, even in underdeveloped countries and regions, so it is necessary to apply technological solutions for information protection, at least the use of communication channels based on complicated signals, for example, such as LFM or TSK signals, described in the works [22–24].

Geospatial Peacekeeping-Intelligence (GPKI) and IMINT are derived from the analysis and interpretation of images. These images can be obtained by directing the unit's ground patrols supported with documentation equipment, UAS (Fig. 11), or through RFLs to other units and agencies. IMINT can provide a single snapshot in time or routine comparisons of the same selected areas of interest. GEOINT is geospatial information that describes, assesses, and visually depicts physical features [25, 26].

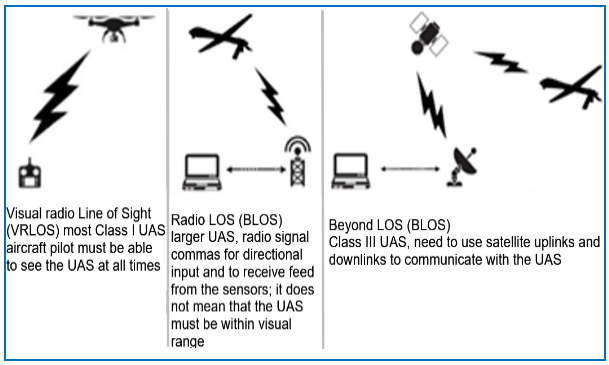

Fig. 11. Ways of organizing remote radio control UAS

In UN missions, a wide range of technologies and tools represents GPKI means.

In particular, these are manned and unmanned aerial reconnaissance vehicles.

A variant of the UAV array in the peacekeeping mission is presented in the Table 1.

Table 1 – **UAV array in the peacekeeping mission (Variant)**

Class	Category	Recommended employment	Normal approximate operating altitude AGL	Range	Recommended C2 level	UAS Examples
I	Small	Tactical unit	< 300 m	< 50 km (RLOS)	Battalion/ Regiment/ Sector	SCANEAGLE SHADOW 200 LUNA
	Mini	Tactical sub-unit (manual)	< 300 m	< 25 km (RLOS)	Company/ Platoon/ Squad	RAVEN ALADIN; PUMA
	Micro	Tactical sub-unit (manual)	< 120 m	< 5 km (RLOS / VRLOS)	Platoon/ Squad/ Team	WASP II; MIKADO DJI PHANTOM 4 DJI MARVIC Pro
II	Tactical	Tactical formation	< 6000 m	< 200 km (RLOS)	Brigade	HERMES 450 FALCO SPERWER
III	HALE	National	< 20000 m	Unlimited (BLOS)	AOR/ mission	Global Hawk
	MALE	Operational/ theatre	< 14000 m	Unlimited (BLOS)	AOR/ mission	HERON-1

Along with using drones as part of countries' role in UN peacekeeping forces, such as Heron [27]. Israel's Heron drone completes the first successful mission in Mali means contract firms are used, for example, such as MAG aerospace [28] one of the last to sign such a contract for support in the MINUSMA mission (Mali). MAG Aerospace provides ISR missions for the benefit of MINUSMA (Mali) evaluation of the use of such services was carried out by scientists of Joint Air Power Competence Centre [29] and came to a positive conclusion. And the ways to process obtained images are improving all the time, example we can find in work [30].

Camp Security Suite – Core Technologies

The variant of the classification of Camp Security Suite and Core Technologies systems is presented in the Fig. 12.

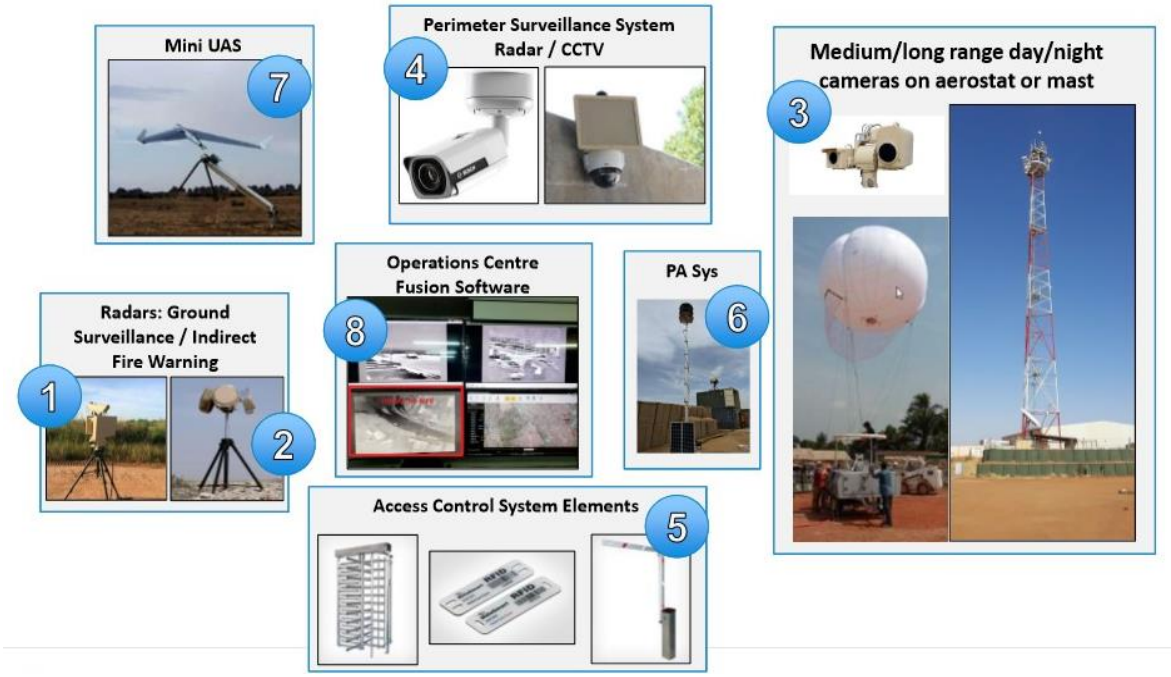

Fig. 12. Camp Security Suite – Core Technologies

Ground Surveillance and Indirect Fire warnings. Threat situations to mission sites can deteriorate quickly and there have been several instances of riots targeting UN personnel and premises. Depicted in Fig. 13 is an example of the Medium range Electro-optical System camera in Gao camp (Fig. 13, a) and the long-range surveillance Camera complex system in Mopti camp, MINUSMA (Fig. 13, b).

a b

Fig. 13. a – Medium range Electro-optical System camera in Gao camp; b – Long range surveillance camera complex system in Mopti camp

These projects are aimed at enhancing security and protection in camps to minimize the impact of threats through the deployment and fully managed operation and maintenance of specialized equipment. Carrying on this, Advanced Threat Detection and Sensor Information Fusion System Services Project in MINUSMA has been started the project aims to provide greater security and protection at the Gao Camp to reinforce existing measures. This includes the deployment and operation of a modern information fusion system with integrated day/night sensors (cameras and radar), the installation of a 45 m mast for the sensors, and sensors at the Gao airport. The project has assisted the UN to learn from the technology and in developing the integrated camp security and early warning system contracts for all missions.

Perimeter Surveillance System Radar (Fig. 14) is aim to enhance the security level of camps protection, to minimize threat exposure through the deployment and fully managed operation and maintenance of specialized equipment.

Fig. 14. Ground radars and public address warning (PAW) system in Kidal camp and Mopti camp, MINUSMA

The MINUSMA Mission Secure Network (MMSN) provides a platform for secure network collaboration within the peacekeeping intelligence community in the mission. It is used to process, analyze and share information gathered through a wide range of sources, which are collaborated to provide the mission leadership with a better understanding of the realities in the area of operations [31].

One of such an early warning systems GA 10 (see Fig. 15) was deployed by the United Nations Mission in Mali (MINUSMA) in the Kidal camp. Among many other incidents, it saved lives on 8 June 2017 when the camp was attacked by rebels, when rockets and mortar rounds hit the camp [32].

GA 10 key Features [33]:

- 360° azimuth coverage;
- coverage up to 10 km;
- long early warning time;
- fully automatic, all-weather operations;
- configurable alert zones (per positioning of the Alerter);
- dynamic Least Jammed Frequency Search.

Fig. 15. Ground Alerter 10 (GA10) from the Thales company [33]

Medium/long-range day/night cameras on aerostat or mast (Fig. 16). Such aerostats were recently deployed in the Central African Republic capital, Bangui. Such aerostats may carry sensors, daylight, and thermal cameras. In addition, aerostats are now deployed in northern Mali, soon to be augmented by counter-battery radars, to allow accurate and timely counter fire against mortar and rocket attacks that often harass the peacekeeper's bases [34].

Fig. 16. Cameras on aerostat, UAV or mast [34]

Mini UAS for camp security. The project provides threat assessment for convoy protection and other operational requirements.

Depicted in Fig. 17 is the Unmanned Aerial System Orbiter 3 [35], which was deployed in the Central African Republic under the framework of a project "Force Protection and enhancement of Security Technology Services in MINUSCA (United Nations Multidimensional Integrated Stabilization Mission in the Central African Republic)".

Key features and capabilities:

- highly transportable vehicle-mounted system;
- tri-sensor payloads for day, and night;
- operation under clouds;
- rapid deployment, 7- minutes to launch.

Fig. 17. Orbiter 3 Unmanned Aerial System used in MINUSCA [35]

Conclusions

This paper has attempted to analyze progressive field mission information technologies used in peace and security operations.

The following conclusions can be drawn from this analysis:

- peacekeeping missions differ from combat missions in the way they are conducted. The principle of protection, communication and reconnaissance is not the same;
- the integrated use of a variety of technologies has created a state-of-the-art information management system for UN peacekeeping operations.

Participating countries' statutes should consequently reflect principles for organizing information and telecommunication support for peacekeeping operations to facilitate personnel's understanding of the tasks and ways for carrying them out.

Prospects to be developed in the future works

Further research should be focused on substantiating the tactical-technical and financial-economic indicators of the technical means of the proposed modern information systems for UN peacekeeping operations.

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Передові інформаційні технології (C4ISR) на службі польових миротворчих місій

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Анотація. Стаття присвячена вивченню досвіду застосування передових інформаційних технологій в польових миротворчих місіях ООН (тактичний рівень військового управління), зокрема на предмет можливості використання в бойових операціях в інтересах національної безпеки та оборони. **Метою дослідження** є аналіз передових інформаційних технологій, які використовуються в польових місіях операцій з підтримання миру і безпеки. **Методи.** Дослідження базується на використанні загальнонаукових методів досліджень: як емпіричних (спостереження, опис) за досвідом особистої участі авторів в миротворчих місіях ООН, так і загальнотеоретичних (аналіз, синтез, узагальнення, класифікація тощо). **Завдання дослідження** полягає в аналізі та узагальненні основних передових технологічних рішень, реалізованих у діяльності польових миротворчих місій ООН у сфері C4ISR (концепція командування, управління, зв’язку, комп’ютеризації, розвідки та ситуаційної обізнаності). **Результати дослідження** свідчать про те, що використання передових інформаційних технологій дозволило створити найсучасніші системи отримання та обробки інформації в миротворчих операціях ООН. Принципи організації управління, зв'язку, розвідки, ситуаційної обізнаності та безпеки військ в миротворчих операціях здебільшого схожі з тими, що застосовуються в бойових операціях. Але миротворчі місії відрізняються від бойових за метою та способами їх проведення, тому засоби їх забезпечення різні, відтак, системи C4ISR не можуть бути аналогічні. Але окремі елементи систем C4ISR в операціях з підтримання миру і безпеки, зокрема, ефективні C4ISR сили і засоби фрагментально доцільно застосовувати і в бойових операціях. Результати дослідження можуть бути використані для плануванням та організації систем зв'язку та інформатизації як в операціях з підтримання миру і безпеки так і в операціях з відбиття збройної агресії.

Ключові слова: інформаційні технології; телекомунікації, зв'язок; миротворча діяльність; C4ISR.