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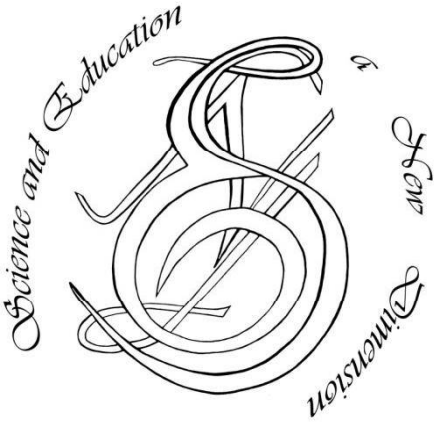

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CONTENT

Rationale use of unmanned aircraft technology as a means of detecting accidents and emergencies situations

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Abstract. In the article the statistics about emergency situations in 2016 and on the number of existing major hazard in Ukraine were analyzed. Based on the analysis introduction in Ukraine of the system for remote monitoring in radioactive and chemical dangerous objects, which includes the use of unmanned aircraft technology was proposed. The research of Ukrainian production "drone" for civil protection and presents its main specifications of which will depend on the success of implementation of its tasks was held. The experience of similar systems used for remote monitoring of certain dangerous objects in Britain was analyzed.

Ключові слова: *monitoring system, civil defense, unmanned aerial vehicle, high risk object, radioactive and chemical danger.*

Introduction. Ensuring the safety of society - a complex scientific and engineering applications, which requires solving complex problems of organization management, forecasting and monitoring of natural and manmade emergency situations (ES).

According to the official website of the State Emergency Service of Ukraine (SESU) in 2016 in Ukraine were happened 149 emergencies. Of these, 56 - manmade, 89 - natural and 4 - social. Due to these emergencies situations killed 183 people (including 37 children) and injured 1,856 people (including 861 children). To the present amount of emergency shows that the largest number of people killed and affected by emergencies is manmade. The total number of emergency situations in 2016, compared with 2015 year increased (148 emergencies situations) and this tendency continues. With the increase in the total number of emergency in Ukraine and increase amount killed and injured as a result of manmade emergencies should focus on new methods and ways of prevention and detection of accidents with the release of dangerous chemicals and radioactive substances in industrial objects.

According to the official report SESU of state supervision of civil protection in the field of technological security for potentially dangerous objects and high risk objects as of December 2016 were registered in Ukraine 6098 high and 22,924 potentially dangerous objects. In addition, in Ukraine there are four active nuclear power plants (Zaporizhska, Rivnenska, Khmelnytska, Yuzhnoukrainska), which has 15 power units with total capacity of 13,880 MW, also in Ukraine carried out the extraction of uranium ore in the Kirovograd and Central Ukrainian uranium areas creating additional radiation hazard country.

Formulation of the problem. Security of dangerous chemically objects (DCO) depends on many factors, including: physical and chemical properties of raw materials, intermediates and products; the nature of the process; design and safety equipment; the storage and transportation of chemicals and other factors. Analysis of the chemically hazardous industries shows that their production lines are small number dangerous chemical items (DCI), and the larger number of dangerous substances is available at the company's warehouses. With the destruction of the substance is distributed outside the company, causing mass destruction of not only the personnel of the object, but also the population living nearby.

For any emergency phase characterized the emergence, development and decline hazards. In the dangers chemically objects may wake several damaging factors - fire, explosions, chemical pollution of ground and air and outside the facility - pollution. The main damaging factor in the accident in DCO is the chemical pollution of the surface of the atmosphere, which results in destruction of people in the area of materials.

Events in Romania in 2007 with the release of large quantities of cyanide in the river water and contamination from the accident at the mine for the extraction of nickel "Talvivaara" Finland, which occurred in 2012, forced to think about qualitative chemical and radiation reconnaissance and monitoring in the territory our country as according to statistics, in Ukraine there are many dangerous objects, an accident which can cause chemical and radioactive contamination. Especially important was the question that today, as in Ukraine are sabotage groups that perform tasks for disabling of civil protection, critical infrastructure and military installations, as happened at a military base in Balakleya at the end of March 2017 year, where multi-site storage of rocket and artillery exploded (fire) that caused the detonation of ammunition.

In view of the foregoing, the relevance of the study and monitoring areas around dangerous objects is becoming increasingly important. However, for qualitative observation of large areas requires appropriate tools and software by which to implement effective chemical and radiation survey as in case of emergencies and to prevent it.

The main material. For this purpose, monitoring and surveillance in the world gained widespread use of unmanned aerial vehicles (UAV). UAV - aerial vehicle which carries the departure and return without the physical presence of a pilot on board.

With the development of modern technology is gaining increasingly popular use of drones in various areas of civil protection - from the area of remote sensing to identify hazardous chemicals that help in the short term to assess the state of a large area of the study in terms of pollution [1, 2].

In Ukraine there is a one prototype unmanned aerial vehicle that is designed exactly for this purpose - UAV «Viper SM 3» [3].

UAV «Viper SM 3» is designed to perform the tasks assigned to the single state system of civil protection of Ukraine, namely monitoring and observation of hazards in the event of emergencies situations. It has a multi-purpose and can be used for aerial photography areas, with the purpose of security at a certain perimeter, it is also possible to use it for monitoring natural and man-made disasters.

Ukrainian unmanned aerial vehicle «Viper SM 3» is made in an unusual configuration, including rotor unit located on three separate consoles (Fig. 1), which improves the quality of maneuvering drones, providing it with good aerodynamics. Sizes of UAV «Viper SM 3» is quite compact - with length and width of the device 65 cm (without screws), its height is 20 cm, and provides drones weight 5 kg. Thus its load capacity is equal to its weight of 5 kg and at altitudes of up to 2 km. Radius of use UAVs to 6 km with a flight duration of 20 to 50 minutes depending on the workload of the unit.

Fig. 1. General view of the Ukrainian unmanned aircraft «Viper SM 3»

Additionally, the UAV can serve as a carrier of:

- HOES (Hidrostability optoelectronic system) sensor with high resolution visible range;
- HOES sensor with high resolution infrared range, to monitor and identify areas of fire in forest areas [4, 5];
- photo fixation optical system with high resolution;
- suspension system of special use (geodetic, radiometric, gas analyzed, dosimetry).

Prospects of application UAVs in civil protection are obvious, given its characteristics. Although Ukraine in the implementation of "drones" in professional activities SESU still under development, it is necessary to consider and implement the best practices of foreign rescue services, which have long been widely used and such types of industrial monitoring high risk. Also, a big advantage of using the technology of unmanned aerial vehicle is that a man or a rescuer is safe, and that is the top priority in the liquidation of any accidents.

Thus, the British firm ImiTec Limited has developed and implemented remote monitoring system at high risk objects «ImiTec RIAS» and «ImiTec AARM».

The monitoring system Airborne ImiTec Advanced is simple and universal, it has radiation detection antenna and the ability to fly at low altitude. Unique remote isotopic analysis of «ImiTec Radiation isotope analyzer system (RIAS)» is made of lightweight gamma spectrometer, which uses custom software to process data on radiation. It allows getting high-quality image of radiation. The system can be integrated into many different platforms, including ground vehicles and remotely piloted UAV's.

Remote isotopic analysis of «ImiTec RIAS» is a radiation monitoring system that detects, characterizes and displays radiological contamination. It has sensors for data collection, microcontroller and software to interpret the data and create maps showing the location and intensity of the radiation radioactive type.

RIAS system can be used to detect radiation at nuclear energy objects, defense industry, in the mining, in reconnaissance, and so on. Data collected through RIAS, include location, calculations, the radiation intensity and energy, well-characterized danger arose. During the monitoring operations, locations and calculations sent in real time to operators who monitor the results. All data stored on the SD - card with an option to download the Internet. Estimates of the extent of zones and radiation generated maps sent locally on a single central server ImiTec.

The company has also developed a system of autonomous airborne radiation monitoring system that uses accessible and universal UAV «ImiTec RIAS» (Fig. 2). Airborne Advanced Radiation Monitoring (AARM) at low altitude provides radiation detection and can be adapted to regular monitoring of dangers radiation objects to respond to nuclear accidents or incidents related to the release of radioactive substances.

Fig. 2. Universal drones «ImiTec AARM»

AARM has the flight time of 45 min, flight range of 1 km and optimal weight less than 7 kg. Advantages of AARM are minimal risk for the operator, rapid response programmed flight trajectory, fast and detailed research.

Conclusions. Given the characteristics discussed in the article UAV is clear that the prospects for their use are appropriate and reasonable.

Another important factor that shows the effectiveness of the technology of UAV's is their constant improvement. World remote observation constantly modified to perform effective monitoring, and the introduction of these technologies in radioactive and dangerous chemically objects approved in some countries by law. Implementation of such systems on separate objects according to the UK Official Site Fire and Rescue Service UK [6]

prevented the emergence of five emergency situation, the consequence of which could suffer up to 3000 people. Therefore, the State Emergency Service of Ukraine should begin to introduce world experience using observation systems at high risk objects bearing radioactive or chemical hazards. In the future it will help reduce the number of emergency situation and, more importantly, to avoid human and material losses.

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Обоснование использования технологий беспилотных летательных аппаратов, как средства детектирования аварий и аварийных ситуаций

А. П. Гаврись, А. Б. Тарнавский, М. З. Лавривский, Р. Б. Веселивский

Аннотация. В статье проанализированы статистические данные возникновения чрезвычайных ситуаций и данные о количестве объектов повышенной опасности территории Украины на 2016 год. На основе проанализированных данных предложено внедрение в Украине системы дистанционного наблюдения на радиоактивно и химически опасных объектах, которая включает в себя использование беспилотных летательных аппаратов. Проведено исследование «беспилотника» украинского производства для выполнения задач гражданской защиты и его основные технические характеристики. Кроме этого, проанализирован опыт использования аналогичных систем дистанционного наблюдения на отдельных опасных объектах Великобритании.

Ключевые слова: *система наблюдения, гражданская защита, беспилотный летательный аппарат, объект повышенной опасности, радиоактивное и химическое опасность.*