



¹Richárd PETŐ

SOME SAFETY AND SECURITY ISSUES OF UAVS

¹. Óbuda University, Doctoral School, Budapest, HUNGARY

Abstract: UAV or drone technology has become easily available, and the drone has grown into an affordable and effective device for some commercial and business sectors. These sectors quickly realised that drones are cost- and time-effective therefore they quickly adopted them. Unfortunately, drones are favoured by criminals too. In the following, the article discusses the construction and operation of UAVs in connection with safety and security requirements. The article focuses on the main processes only without providing any details of previous documents or information on processes of obtaining such document.
Keywords: UAV, drone, RC, safety and security, terrorism, explosive devices

SAFETY AND SECURITY REGULATIONS OF UAVs

The supreme law of Hungary is the Fundamental Law, the highest level of legal regulation in Hungary. It contains and comprises the most important regulation related to the structure and functioning of the State. It determines social, political, and economic segments, and also it contains rights and obligations of people. It sets forth in Articles XVII and XX that: [1]

1. Every employee shall have the right to working conditions which respect his or her health, safety and dignity.[1]
2. Everyone shall have the right to physical and mental health. [1]
3. Hungary shall promote the effective application of the right referred to in Paragraph (1) by an agriculture free of genetically modified organisms, by ensuring access to healthy food and drinking water, by organising safety at work and healthcare provision, by supporting sports and regular physical exercise, as well as by ensuring the protection of the environment. [1]

Act XCIII of 1993 on Occupational Safety and Health (OSH) makes provisions on the necessary factors of safe and healthy working. It precisely determines the roles of the State, and those of employers and employees – “the three roles” – including their rights and obligations. However, it does not provide a factual solution, although it contains the main objectives, established by the Fundamental Law.

The Act orders that employers need to ensure safe and healthy working conditions. An employer needs to make a risk analysis and own working regulation. The employee sector needs to follow the working regulations of the employer, and the International Labour Office surveys both employees and employers how they fulfil the requirements.

In Hungary the National Transport Authority (NTA), as the central institution of transportation, manages independently [2]: road transport; civil, state aviation; road; railways; shipping and others.

The main objective of the Authority is to maintain a high level of transport safety in accordance with the goals set forth by the European Union in this field.

The Aviation Authority (part of the NTA) provides civil and military aviation management tasks. Presently it does not have an operative regulation for drones yet, although the Authority made a regulation plan whose estimated time of entering force is June 2017.

SAFETY REQUIREMENTS

The state, employee, and employer have their own tasks to realize safe and health working conditions set forth by the OSH.

Conventional risk analysis

First of all, before launching a working process the employer has to create safety documents and do training for employees. The types of safety documents depend on the activities of the employer. The OSH requires a risk analysis document as well.

It is a fundamental safety document that every employer needs to create. Risk analysis is useful in many situations [3]:

- It anticipates and “neutralizes” potential problems;
- It helps to prepare for events, such as equipment or technology failure, staff- environment accident, a broad range of crimes, natural disaster;
- It assists when need to make a decision whether or not to do something. This allows the management to be able to make better strategic decisions;
- It provides good possibility and background assistances to staff training;
- It increases teamwork by increasing openness, honesty and understanding within the project team;
- It helps to manage cost commitments and profit forecasts which will be accurately stated for each level of risk.

Risk analysis is divided in two parts [3]:

▣ Risk assessment

This part of the document identifies, evaluates, and measures the probability and severity of risks. The aim of risk description is to display the identified risks in a structured format. The widespread schema is the table form where the use of a well-designed structure is necessary to ensure a widespread risk identification, description and assessment process. The consequence and probability of each of the risks set out in the table should allow the prioritization of the key risks that need to be analysed in more details. Risk estimation can be quantitative, semi-quantitative or qualitative.

Using risk assessment techniques to obtain (more) realistic estimates will result in a more attainable plan. It fully discloses the sensitivity of the work, process or project to its participants in order to ensure that all threats are fully understood. Although, at times new risks appear, for that reason risk assessment techniques must be reconsidered.

▣ Risk management [4], [5]

Standards have been developed by several organizations, such as the International Organization for Standardization (ISO), Institute of Risk Management (IRM), the Association of Insurance and Risk Management (AIRMIC), and the Public Risk Management Association (PRIMA). This part of document helps to decide what to do about risks. It summarizes the possible and chosen solutions in a short form considering cost-effective approaches.

Suggested methods of the OHS are: [6]

- Elimination and substitution

One of the best solutions is to remove a hazard from the workplace, or substitute (replace) hazardous materials or machines with less hazardous ones. Removing the hazard from the workplace results in the elimination of a threat. Using the same chemical but in different form is

the other type of substitution. It is important that one hazard should not be traded for another one.

Example: Dry, dusty powder may be a significant inhalation hazard, but if this material is available and usable as pellets or crystal, there may be less exposure.

- Engineering Controls

It includes designs or modifications to plants, safety equipment, or system (such as ventilation systems, motion detector, etc.) processes that reduce the source of exposure. A preventer system of human and technology errors is also included.

Examples:

- » Process control. Changing the way a process, or a job activity is done in order to reduce the risk. (Using automation results in a lower level of human risk.)
- » Enclosure and Isolation. These methods aim to physically separate a hazard from humans or environment. (Manipulate hazardous material in glove box, a.k.a. sealed container.)
- » Ventilation. This method controls air rate, is able to add and remove air in the work environment. (Smoke-exhauster removes smokes from work environment.)

- Administrative Controls [7] [8]

These are controls that define the way the work is done. Administrative controls include timing of work, employer rules and law, personal responsibilities, work practices, such as standards, operating procedures (including training, education, management, equipment maintenance, and personal hygiene practices) emergency preparedness and previous experience.

» Working time, scheduling

Job-rotation limits the amount of time a worker is exposed to a substance. Work/rest schedules limit the length of time a worker is exposed to a hazard. When few workers are employed in a working environment it is suggested to schedule the maintenance and high exposure operation.

» Work practices, experience

It is based on previous human and technical errors of working and on lessons learned from “How do not do that/ How do that” experience.

» Education and training

Several processes and equipment require specific qualification. Education and training help to minimize risks and they give a possibility to ensure that workers understand hazards, risks and they are able to do cooperative and safe work.

» Housekeeping

The housekeeping training helps understand the risks stemming from disorder set in a workplace. Measures taken decrease risks of being hit by falling down objects, of slipping on greasy surfaces, of cutting or puncturing the skin and body.

» Personal hygiene

Personal hygiene training helps to reduce the amount of a hazardous material absorbed, ingested or inhaled. (Separate hand washing, working, eating - drinking, and smoking, etc. areas,)

» Emergency preparedness

It ensures that the employees know what to do when something unplanned and unexpected happens (fire, electrical malfunction, UAV crash, etc.). The employees have to be provided with emergency plan, necessary equipment and supplies, contacts with relevant authorities, and practice emergency procedures correctly.

- Personal Protective Equipment (PPE) [9]

Equipment worn by persons to reduce exposure such as inhalation (breathing in), skin (or eye) contact with, or swallowing (ingestion) of chemicals or exposure to noise. The PPE includes items such as protective clothing, gloves, face shields, eye protection, footwear, respirators which serve to provide a barrier between the wearer and dangerous material, chemical or others occurrences as radiation, emission.

It is important that the PPE should never be the only a method of eliminating or reducing exposure because it may fail. Failure can happen when an employee does not wear the PPE, or it is damaged, does not fit the worker, or does not fulfil the requirements of the necessary protection class.

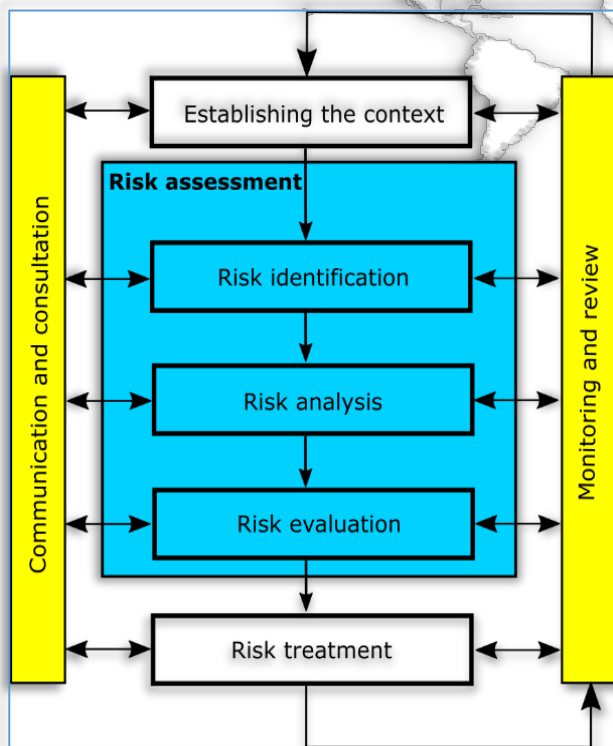


Figure 1: Process of risk analysis¹

¹ Author edited,
<https://law.resource.org/pub/in/bis/S07/is.iso.31000.2009.pdf>;
Downloaded: 10th 02 2017.; p. iii

These tasks conceive methods known as hierarchy of control. The first and the best is to try to eliminate the hazards and the last is the use of PPE.

ISO 31000 RISK MANAGEMENT

The ISO 31000 Risk Management discusses another aspect of risk analysis. It puts emphasis on the risk analyses of organization structure and processes. Therefore the standard offers and extricates solutions from OHS. [10]

- Risk avoiding. It means not getting involved in a business, passing on a project, or skipping a process or a high risk activity. This is the most expedient way to keep off disruptive and costly events.
- Risk sharing. Risk can be optimized if processes and tasks are shared with a third party (other people, teams, organizations, etc.).
- Risk control, includes detection recon and preventive action.
 - » Risk detection means that threats, dangerous processes and actions, critical events are revealed before something could go wrong.
 - » Preventative action as EHS training; special, coordination, process training aim to prevent high risk situation from happening.

Each action must be checked before and after an event or situation.

- Risk accepting,

It is one kind of response to risk when the cost of avoiding the risk is much higher than the cost of accepting it. This is the last solution to use only if avoiding, sharing, or controlling are not possible choices. Such an approach may help improve the identification of threats and opportunities and effectively allocate and use resources. Using ISO 31000 facilitates that an organization is able to achieve its objectives more efficiently. [11]

ISO 31000 AND CONVENTIONAL RISK ANALYSIS

The more details the framework and process have at their levels the easier it is to collaborate and coordinate for each team of that organization.

If risk assessment and treatment (at process level) are sufficiently detailed (threats, likelihoods, risks) and other important information facilitating fast decision-making is also available, it will result in:

- decreased risk (likelihood, severity);
- decreased penalty by authority (likelihood, value of penalty);
- facilitating smooth and successful work process;
- increased collaborating actions between the team of executors and management levels;
- increased likelihood of finishing the project in time.

If the previous requirements are partly or not realized a lower efficiency of work process can occur. If final work is not completed in time the possible disadvantages are:

- increased overall costs,
- financial loss,
- no new projects can be undertaken (if resources are limited).

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HARMONY BETWEEN COMPANY ACTIVITIES AND OCCUPATIONAL SAFETY AND HEALTH REQUIREMENTS

The manufacturing of a UAV is the most complex if the UAV's hardware and software elements are designed, produced and programmed by one company. In this case the company first needs to get an operating licence and evolve conditions of workplaces fitting the function. In the following chapter the construction and operation of UAVs will be discussed in connection with safety and security requirements. The article discusses only the main processes and does not provide any details of previous documents or on the processes of obtaining such documents.

Therefore the activities are divided into two sections:

1. Evolving workplaces;
2. Producing UAVs.

The figure below shows the main rooms of a factory, and the main process of evolving requirements at the management's levels.

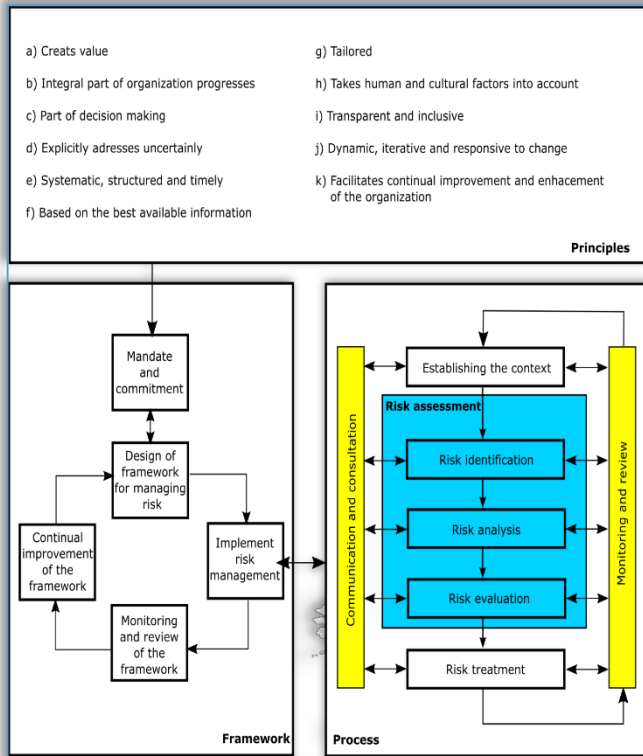


Figure 2: Relationship between the risk management principles, framework and process²

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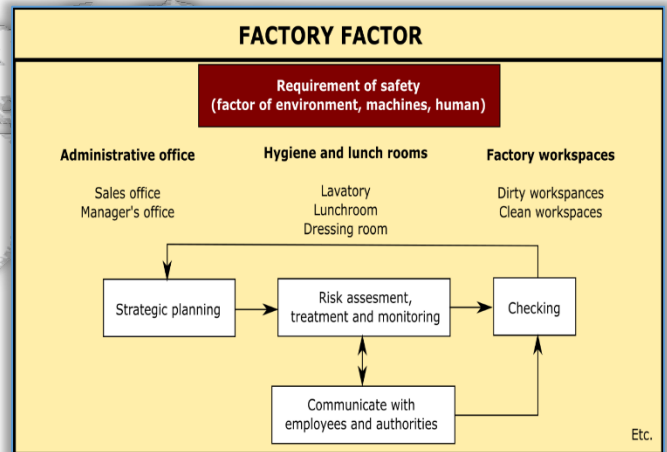


Figure 3: The main process of safety requirements in a factory³

The figure above shows the main rooms of a factory:

- Administrative office:
 - » sales management and administrative tasks;
- Hygiene and lunch rooms:
 - » lavatory;
 - » lunch room;
 - » dressing room;
- Factory workspaces:
 - » dirty workspaces (painting, assembly, soldering, etc.)
 - » clean workspaces (programing, minor testing, etc.)

² Author edited,
<https://law.resource.org/pub/in/bis/S07/is.iso.31000.2009.pdf>
Downloaded: 10th 02 2017.; p. iii

³ It is not a complete overview.

In order to do the eligible development required by law, first a step-by-step risk analysis has to be carried out. The process must be systematic because the risks, aspects and settings continuously change.

The next figure shows the tasks of a UAV factor. The UAV factor includes planning, constructing and testing processes of UAVs and of other equipment of UAV, such as sensors, cameras, telecommunication systems.

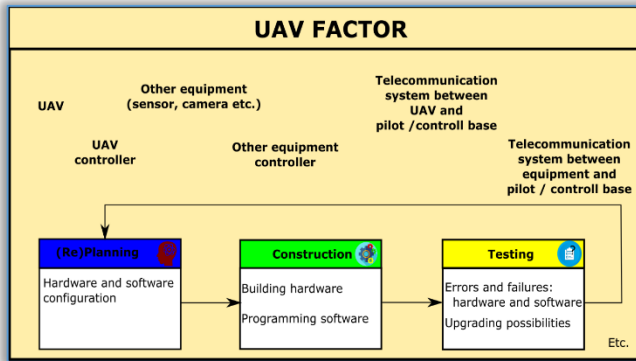


Figure 4: The main process of UAV manufacturing and operation⁴

All equipment (UAV, UAV controller, sensors, telecommunication systems, etc.) needs to go through a procedure as:

1. (Re)Planning;
2. Construction;
3. Testing.

If the equipment must be upgraded, or result of tests is not eligible, the process starts again with step one: re-planning.

Some testing and construction methods can be done both inside and outside the factory.

Each factors, processes, and tasks need to be in harmony with the relevant legal regulations.

UAV-RELATED RISKS

The previous chapter of this article describes some OHS, NTA requirements, and risk analyses in connection with UAV's safety. What about UAV-related risks?

In the last three-four years, the usage of UAVs generated a huge and significant chaos worldwide. Everything started with package delivery, illegal observation of private sphere, and recordings. [12]

The observation and making illegal recordings of private sphere or secured objects (army bases, embassies, etc.) are critical points of UAV use, because a lot more information can be gathered immediately by UAVs as with the use of other methods. If an

unauthorised person gathers confidential information, this fact increases the risks of that particular facility.

The law provides for data protection and operating UAVs very strictly, but legal prohibitions do not deter criminals from conducting unlawful activities.

SkyJack is the name of the drone hacking program which is able seek out and hack other Parrot drones through their wireless network. A SkyJack pilot has the ability to control and view the camera sources of the affected drone. [13]



Figure 5: Illegal observation and recording⁵



Figure 6: A UAV that carried a 40mm rifle grenade⁶



Figure 7: Homemade kamikaze UAV⁷

⁴ It is not a complete review.

⁵ <https://www.offiziere.ch/wp-content/uploads-001/2016/10/Screenshot-2016-10-04-16.20.19-e1479065908334.png>; Downloaded: 28th 02 2017.

⁶ Iraqi Counter Terrorism Service soldier in Mosul examines an ISIS drone modified to carry a 40mm rifle grenade in the attached plastic tube. Grenade is dropped when the drone is over Iraqi forces. (Mitch

Utterback); <https://017qndpynh-flywheel.netdna-ssl.com/wp-content/uploads/2017/02/Drone-Cup-holders-2-Mitch-Utterback.jpg>; Downloaded: 28th 02 2017.

⁷ <http://u0v052dm9wl3gxo0y3lx0u44wz.wpengine.netdna-cdn.com/wp-content/uploads/2016/04/Armed-Drone-RPG-ISIS.jpg>; Download: 2017.02.28.

Unfortunately, these problems are not commensurate with risks of UAV usage by terrorists. Nowadays, on the radio, television and the internet more and more news report that terrorist use UAVs to ambush military forces and attack civilians. [14]

Most of the modified drones carry some kind of weapons, such as a gun or explosive charges. The latter one is particularly dangerous. [15]

The explosion and fragments are able to cause serious injuries or even death in a large radius if they hit or reach human body. Public places where large numbers of people gather at a time are primary targets.

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5, Revolutiei, 331128, Hunedoara, ROMANIA
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