USING NEXT GENERATION SOFTWARE FOR ANALYSIS OF FATAL FIRE-FIGTHER ACCIDENT

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ABSTRACT

The investigation of accidents occurring during high- or low-angle rope rescue, due to peculiarities and specific circumstances provides us with extraordinary lessons learnt, so that we can disregard the template-like content of minutes taken on work accidents, and used up-to-date analysis methods avoiding subjectivity, like next generation Visual Risk Assessment software and tool, the Bowtie Method (BowTieXP).

The goal of this study is, by elaborating a fatal fire fighting accident, to investigate and analyze the risks of accidents occurring during special rescue operations and to share the lessons learnt with professional fire-fighters in order to avoid similar incidents. The analysis of different risks was performed using up-to date accident investigation methods in order to fully analyze the cause and effect circumstances from all sides.

It can be seen after the analysis of the case that human role is fundamental in the occurrence of the accident, since, substantially; a human error caused the accident. The Human Error of the commander and the fire-fighters strengthened the causes of the occurrence of the accident, which was strengthened by environmental, procedural, training and technical factors.

Keywords:

BowTieXP Software, Fatal Accident, BowTie Method, Visual Risk Assessment, Safety Management System.

INTRODUCTION

The cause and effect investigation of severe injuries during high- and low-angle rope rescue can be regarded as peculiar from many aspects, since due to extreme circumstances and uniqueness, the reasons of these accidents is quite difficult scrutinize posterior, and it is also difficult analyze and evaluate their effects. In Hungary, the accidents within the disaster management system are primarily investigated within a legal framework and are processed based on accidents protocols prescribed thereby. The strict administration liability does not allow the full elaboration, analysis and evaluation of the cause and effect circumstances of accidents and to collect the lessons learnt.

The investigation of accidents occurring during high- or low-angle rope rescue, due to peculiarities and specific circumstances provides us with extraordinary lessons learnt, so that we can disregard the template-like content of minutes taken on work accidents, and used up-to-date analysis methods avoiding subjectivity, like the Bowtie Method [1][2].

DESCRIPTION OF THE SEVERE WORK ACCIDENT

On 1 November, at 17:03 hours, the operations control of the Hungarian disaster management received a notification that a person fell into a ravine outside the administrative

area of an inhabited place and was injured. On the day of the alert, there was no rainfall, it was dark. In addition to the floodlights, there was no other lighting.

During the reconnaissance, starting from the direction of Pilismarót, on a road accessible by a four-wheel-drive vehicle, but not by a fire engine, it took 700 meters to turn up at the incident site. During the reconnaissance, no one was found there, only a soft shouting was heard from the forest. Then, the rescuers went in the direction of this voice. To approach the source of the voice, they had to descend on a slope of 35-40 degrees, covered with leaves and trees, approx. 50 meters to the place of the slip. Rope securing in this place, due to the vicinity and the accessibility of the landmarks (trees, bushes) was not justifiable. The terrain conditions hampered the possibility of skidding. During the reconnaissance, headlights and torches were used.

General description of the incident site: open view on the top of the cliff ledge, climbing 15-20 meters on a slope, relatively steep (approx. 60-70 degrees slope angle), covered with dry leaves and loose soil, opposite of the supposed place of the fall or skidding.

One of the fire-fighters of the rescue team was looking for an anchor point, when he slipped at the place indicated above; first, he skidded approx. 4 meters slowly, then rapidly on an 8-meter-long slope of approx. 60 degrees; and in the following, he fell vertically approx. 20 meters. According to the primary investigation, he died immediately.

WHAT HAPPENED? WHY DID IT HAPPEN?

At the occurrence of an accident, we always investigate the causes: a fire-fighter fell into a ravine. Why did the accident occur? What happened during the accident? – we can ask the questions. We may start the investigation by asking the five why-questions, at the end of which we can find the cause(s) triggering the accident. The fire-fighter, due to the bad visibility and the extreme terrain as aggregate causes of environmental effects did not perceive that he had stepped on to a steep and sloping area, from where he can longer return, there, without rope securing, he would surely fall into the ravine.

Cause		A fire-fighter fell into a ravine.
Why?	1.	He skidded down a steep slope.
Why?	2.	He did not use a securing rope.
Why	3.	He was in a dense woodland with slopes.
Why?	4.	He did not perceive the danger.
Why?	5.	There were limited visibility circumstances.
Consequence		He entered a danger zone.

Table 1: The “5 Why?” questions about the causes of the fatal accident

The area from where it is no longer possible to climb back because it is steep and slippery is called a danger zone by experts involved in cave search and rescue, cliff climbing or mountaineering rescue. The individual sections of the terrain and caves have their danger zones, whose locations and sizes are different, so they are difficult to define, usually they are empirically determined and identified. In the indicated area with ravines, this danger zone was not marked or outlined; such dangers of the area were not known to the rescue unit, and there

is another significant fact that, due the limited visibility circumstances as well, they did not perceive the risks of the mountainous and forested environment.

ANALYSIS OF THE SEQUENCE OF EVENTS – WHO DID WHAT?

During the chronological analysis of the sequence of events, the critical mistakes are unambiguously visible that may have caused the accident. The more different methods we use to analyze the given accident, the more recurring causes we may see, which, individually or collectively, may have resulted in the occurrence of the severe accident. Let us examine the incident with different methods, but first, let us take a look at the circumstances, the sequence of events how the accident may have occurred.

The sequence of events can be reconstructed retrospectively from the minutes of the accident, which clearly shows that the events can be divided into 13 key steps. From the minutes, based on the factual findings of the investigation, critical points can be assigned to the given steps. Collecting the critical points is not yet the analysis of the incident; it is a kind of a sketch of facts. To analyze the information collected from the sketch of facts and the documentation several years and fire fighting and rescue, command and control knowledge and experience are required [3].

Based on the knowledge of the critical points, we can see that the cause of the occurrence of the accident is expected to be complex. Beyond individual responsibility, the correctness of and the lessons learnt from the organization, the commander and the methods and procedure must be analyzed. We should examine how the environment and the level of training, the use or not use of individual protection equipment and other tools and instruments have aggravated the accident, that is how they have increased the occurrence of the accident resulting from skidding, [4].

During the analysis, we always investigate:

- Why did it occur? What would have happened if…?
- Why did a fire-fighter colleague of ours die?
- How can we prevent the occurrence of similar incidents in the future?
- What are the lessons learnt for us?

These questions are not simple because the causes of the given accident are also complex. Each and every critical point involved a risk of certain gravity:

- a long walk to the incident site, which could cause fatigue,
- incorrect information regarding the location and the position of the injured,
- dense woodland with limited visibility,
- steep hillside,
- night darkness,
- presumably lighting devices with poor illumination capabilities,
- difficult terrain, heavy protective clothing,
- slippery terrain, thick litter layer of dead leaves,
- locating the missing person by his voice,
- steep hillside,
- Circumstances of anchoring the securing rope.

RISK ASSESSMENT OF THE FATAL INJURY WITH THE BOWTIE-XP SOFTWARE

The Bowtie representation of evaluating of the causes and consequences of the accident causing a fatal injury is a good method, where the results of the fault tree method and the herringbone technique can be depicted in an aggregate way. The risk analysis of the fatal accident of a fire-fighter and its evaluation and representation using the Bowtie method is shown in Figures 1-3. The left hand side of the bowtie analyzes the causes of the occurrence of the accident; its right hand side analyzes the consequences, effects and aftermaths of the accident. In the centre, we can see the result of the accident as an event and main danger [5].

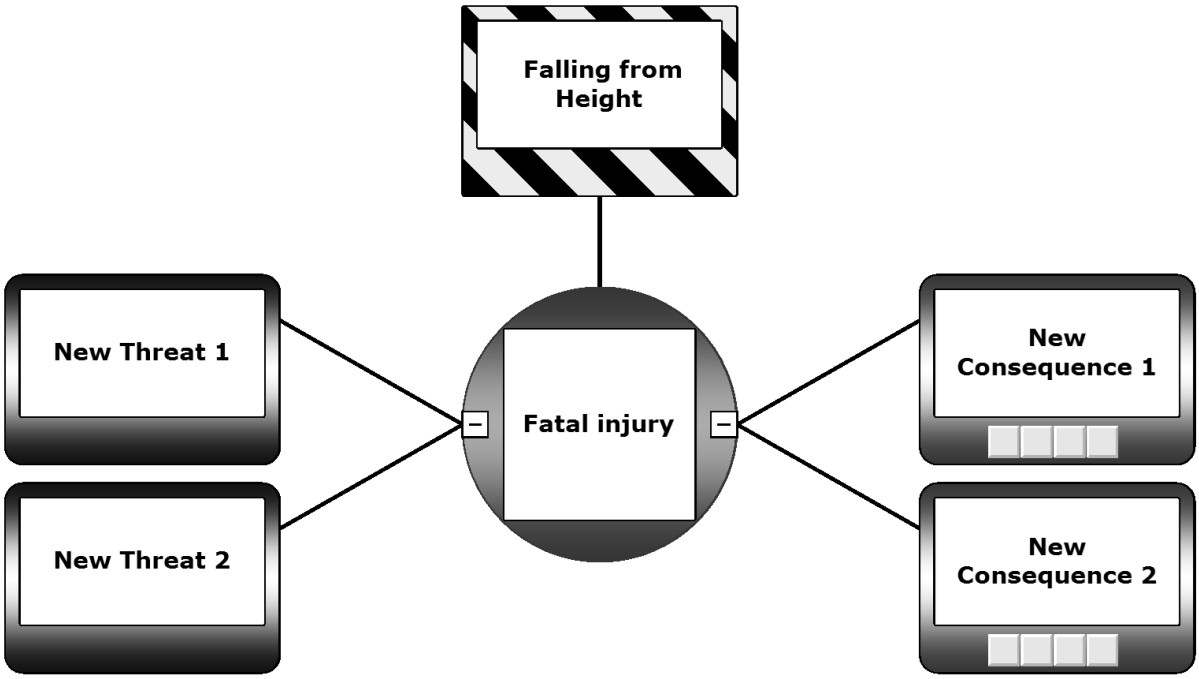

Figure 1, First step: Hazard and Top Event in BowTieXP with Major Accident Hazard

Both sides of the bowtie figure contain the limits that may hinder or mitigate the occurrence of the event, respectively, its effects. So, on one side, data clarification, communication, coordination by the duty office, and on the other side, decisive instruction by the commander, a tactical decision and the training of subordinate commanders [6]. The detailed analyses are depicted by the figures of the fishbone (Ishikawa methodology) diagram and the fault tree method (Event Tree Analysis, ETA).

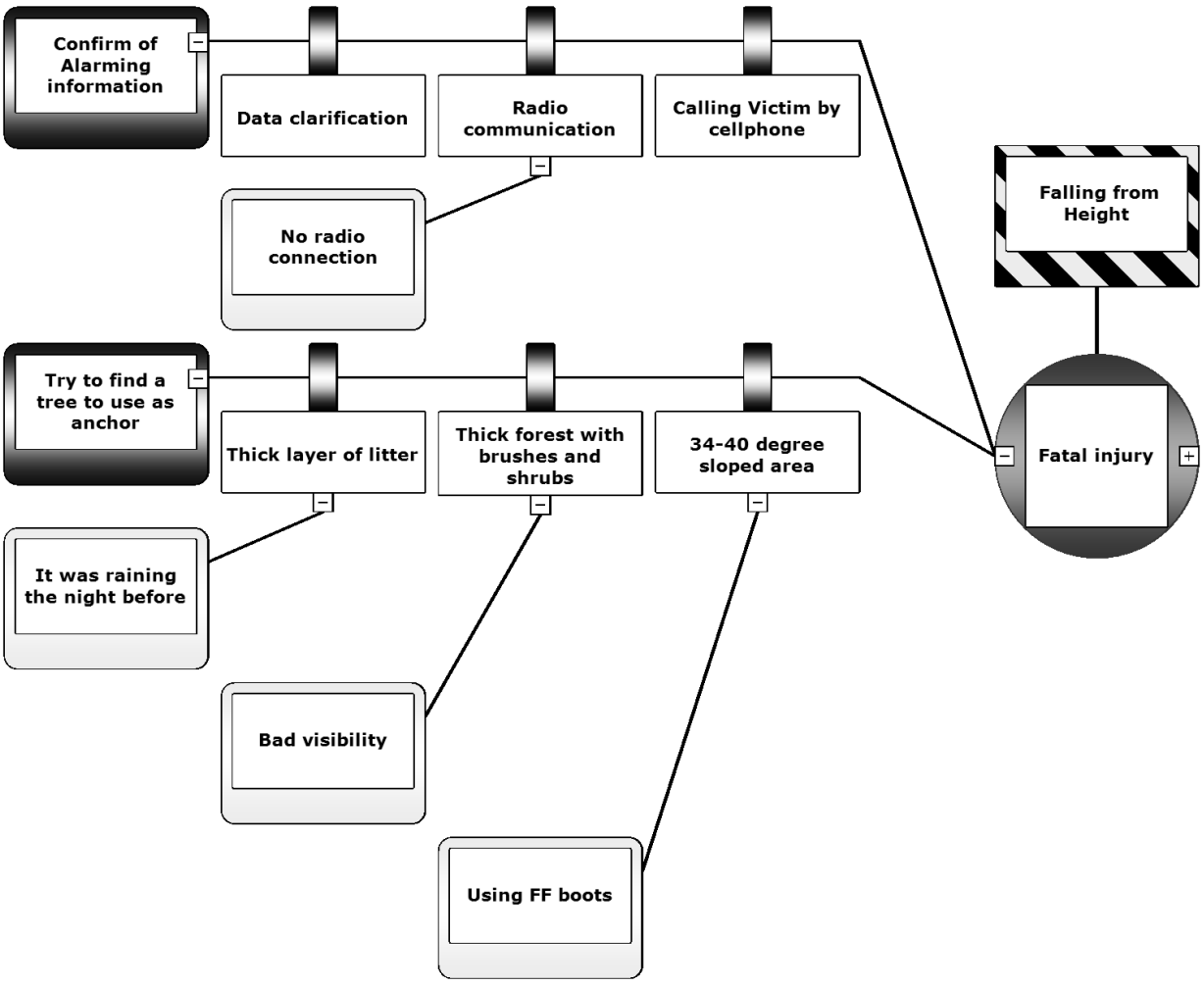

Figure 2, Examples of Hazard, Top Event, Threats, Outcome and Barriers on left side of BowTie diagram with selected Threats

It can be seen, the combined effects of how many circumstances should be considered at the occurrence of an accident [7]. The causes must be analyzed in a complex way, because certain factors strengthen each other, in other words, it was not just a wrong decision by the commander that led to the unfortunate accident. Such joint or aggregate causes were:

1. Walking 700 meters uphill with equipment could have caused the fatigue of the fire-fighter, so he had no chance to hold on to something, having the equipment and the lighting device in his hands.
2. They trusted the GPS coordinates and the information from a layperson, important information on the position of the injured person was not available, which collectively influenced the commander's decisions and the tactics of search.
3. They had limited personnel and assets, since the central duty office had not acted prudently in collecting the information: darkness, inaccessibility by regular vehicles, the injured person was not questioned attentively, no forester with site awareness was called to incident site, no off-road vehicle and supplementary rescue forces were sent to the site [8]. No request was made by the commander of the unit to do so.
4. The commander did not take into account the importance of safety when rescuing with a small number of personnel on a difficult terrain: a firm commander's

instruction on anchoring and the request for additional forces were lacking. There was a fundamental mistake not to approach the victim on the tourist route from the bottom.

5. The team did not have an action plan, as it seemed to be a simple removal of an injured person. They were prepared for a normal terrain based on erroneous information; they had an erroneous rescue tactical plan.

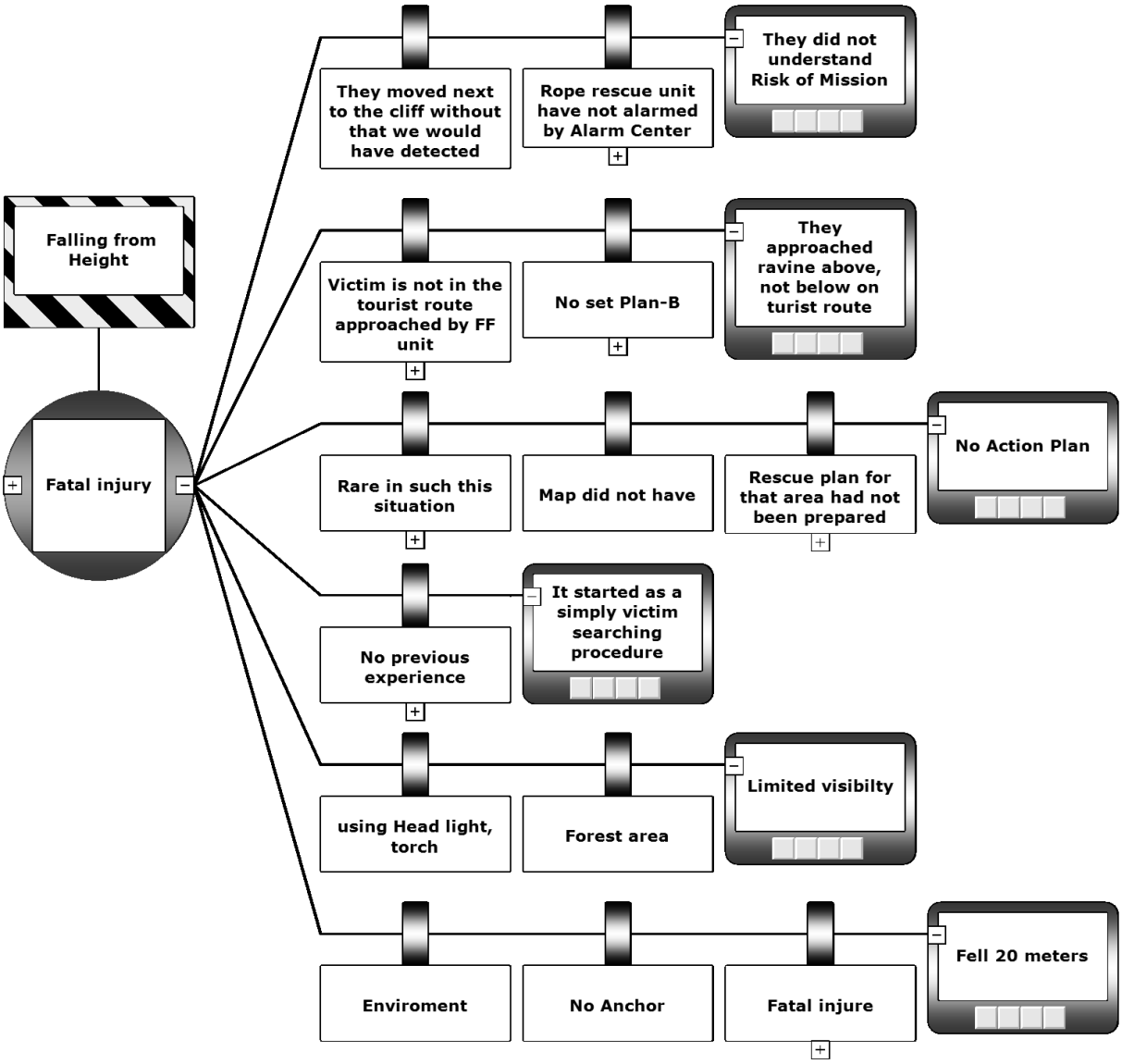

Figure 3, Examples of few Outcome and consequences at left side of BowTie diagram, without barriers

CONCLUSIONS

It can be seen after the analysis of the case that human role is fundamental in the occurrence of the accident, since, substantially; a human error caused the accident. The Human Error of the commander and the fire-fighters strengthened the causes of the occurrence of the accident, which was strengthened by environmental, procedural, training and technical factors [9].

In order to reduce the occurrence of accidents it is important to prepare a person mentally and professionally to keep the safety regulations. The training of subordinate commanders must be emphasized in particular, focused on extreme situations and special rescue.

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Colonel Péter Jackovics, civil protection counsellor, Head of Department for Emergency Response, National Directorate General for Disaster Management (NDGDM), Ministry of the Interior, has two decades of professional experience in domestic and international disaster relief and assistance. He is the commander of HUNOR. He led the governmental rescue team in Srí Lanka, Indonesia, Haiti, Malta and Serbia. He is Hungary's UNDAC expert. As deputy head of the EU civil protection team, he directed the assistance granted by EU countries to Japan. Under his leadership, the basic professional requirements, the National Classification System for voluntary rescue organizations to be deployed in rescue operations have been elaborated in the six different branches of rescue. At present, he is a student of the Security Science Doctorate School of the Óbuda University. His area of research is the risk mitigation of special rescue operations during disaster assistance.

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BENEFITS AND DRAWBACKS OF VIRTUAL CURRENCY BITCOIN

Pavol Jurík

Introduction

According to Šlosár, Šlosárová and Majtán [1] the term currency in general is a comprehensive term referring to a set of money circulation elements regulated by law in a country. Virtual currencies were defined in 2014 by the European Banking Authority as "a digital representative of a value that is not emitted by the central bank or another public authority and it has not a direct relation to a real currency, but is used by individuals and legal entities as a mean of exchange and it can be sent, stored and exchanged in an electronical way." [2] According to [3] "a virtual currency is a digital currency (also called cryptocurrency) or electronic money that do not physically exist as coins or banknotes. People use virtual currencies to purchase goods and services online without expending high transaction fees and charges. The most attractive part of virtual currencies is that they allow their users to remain anonymous." Among many virtual currencies (for example Bitcoin, Ripple, Ethereum, litecoin, Dogecoin, Dash, Peercoin, Stellar and others) the most important and most used currency is Bitcoin. It is also the very first virtual currency, which was created in the year 2009. The issue of virtual currencies is therefore a relatively new area and for many people it is still unknown. This article focuses on the virtual currency Bitcoin. Its aim is to create a complete list of basic advantages and disadvantages of Bitcoin with detailed descriptions of each. In literature these advantages and disadvantages are described only