AVALANCHE CONTROL: INVENTORY AND ANALYSIS OF PREVENTIVE TRIGGERING METHODS IN THE WORLD

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ABSTRACT: Artificial avalanches release is based on the use of specials systems or process and appears to be one of the main solution to cope with avalanches risk. In the world, there are many systems able to trigger avalanches artificially. Nowadays, there is no inventory and analysis of these different methods ; we will try to propose one. It seemed interesting to establish and to propose a list and, above all, a comparison of them through the assessment of several criteria. The global repartition of these systems will be different according to several points. Some of them may be subjected to a certain number of restrictions or regulations relating to their own use. It's necessary to present in parallel the habits, customs of some countries. All these aspects are likely to have a major role and influence at the time of system choice. Finally, several countries don't practice artificial release and/or don't look after this problematic yet. Most of the time, reasons can be financial or political.

KEYWORDS: Preventive avalanche release, efficiency, regulations

1. INTRODUCTION

Avalanches are natural phenomena which are feared and dreaded for a long time. They are responsible for the death of people (40 in France last winter season) and sometimes, for the destructions of houses, damages on roads,..Currently, there are many ways to take precautions against the risk of avalanches. Effectively, we are able to control their flow, to set their starting area and equally to act directly and actively on their triggering. In this last case, we will speak about artificial or preventive release of avalanches. Preventive release appears to be one of the main strategy to safe and secure areas which are open to the public. Indeed, it permits to eliminate the latency danger by triggering avalanches as soon as snow conditions are threatening and sufficient. People responsible for the triggering have the possibility to act in quickly and reliably way during a desired time. Then all security measures can be taken upstream: habitations can be evacuated, roads can be closed to the public for instance. Artificial releases are used in the world to safe ski areas, roads, quarries and habitations (in precise case). As expressed before, there are several approaches to trigger avalanche in an artificial way.

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Several aspects should be taken into consideration to make a constructive comparison of them and to explain at best their presence in the world.

2. SYSTEMS TO RELEASE AVALANCHES

Three groups can be distinguished:

- Systems/practices using explosives: Handcharge, helibombing, Catex®, Avalancheur, Wyssen Lawinen Sprengmast (WLS®), "Lawinenmast" (Innauen Schätti), Avalanche Guard
- Systems using gas: Gazex®, DaisyBell®, Obellx®, Avalhex®.

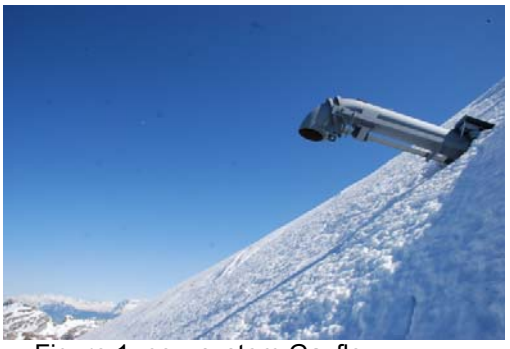

Figure 1: new system Gazflex

- Others: Artillery.

We can tell them apart according to:

- Their raw materials: some will use explosives, while others will use gas mixture.

- Their triggering mode: some of them require the presence of ski patroller above or near the shooting area, while others can be controlled remotely.
- Their mobility or immobility. Some systems are fixed and can only release one path, others are able to reach several points thanks to the use of helicopter or cable for example.

We can compare them speaking about:
- Their effectiveness. For example, several studies demonstrate that an explosion is more effective when it is produced above snowpack.
- The safety of their use. Systems which are controlled remotely are the most reassuring for operators. However, danger is greater for the public (who doesn't contribute to operations).
- Weather: meteorological conditions are likely to constrain some systems use, it will be dangerous and forbidden to fly with helicopter for instance.
- Financial aspects: it will depend on a lot of conditions. Some systems can be cheaper than others (about the initial investment) but can require the purchase of substantial consumables and/or need more operators.

3. REGULATIONS

Regulations are different by country. Each country has got different past, ways of life. Laws are created in order to be adapted to the population need, to prevent further accidents, to control some use. They may be more or less drastic and largely influence the choice of a particular method. They can equally vary according to state, region.
Explosive is obviously the most constraint practice by regulations. In all countries people have to ask some authorization, permits, certificates or whatever to be authorized to get, use, store and transport explosives. They have to respect many guidance, procedures like distances between storages and railways, habitations. Regulations can be a real "brake" and explain in part some choice. For instance, Italians laws are among the strictest, so that in Italy the most used systems are based on gas because they permit to free from this kind of restrictions.
The use of helicopter and others systems can equally be restricted but they are milder compare to explosives.

4. PRACTICES OR "NO PRACTICES"

As we just have seen, regulations can lead to such-and-such system decision. Countries will then adapt their practice according to their restrictions. Swiss, for instance will use lots of explosives because laws are more flexible and permissive. But they are not the only criteria. Ski areas, operators certainly have preferences and habits. It seems to be difficult to make them change even if it could represent a better security or efficiency.
Behaviors can be important too: in this field, Japanese use to wait rather to act because population is very law-abiding and won't go skiing when it's forbidden.
Finally, there are a lot of emerging countries, notably in Asia. Russia will welcome the Winter Olympics game in 2014, in Sochi. It's proved to be necessary and primordial to safe slopes, chair-lift from avalanches. For this, lots of systems of artificial release will be necessary in parallel to the formation of new operators…

5. CONCLUSION

Nowadays, the artificial triggering of avalanche becomes a basis of snow avalanches protection. Depending each on their characteristics, systems to release avalanches present mostly good performances and permit to release avalanche in optimal conditions.
However human decision and experience remain the basis to ensure an intelligent and safe snow avalanche risk management.

6. REFERENCES

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