

# Positioning at the Finnish Voluntary Rescue Service

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**Keywords:** Positioning, VGI, Volunteer Rescue Service

## **SUMMARY**

The Finnish Voluntary Rescue Service (Vapepa) is an organization coordinated by The Finnish Red Cross. The purpose of the Voluntary Rescue Service is to help public authority (police) in cases where the resources of authority are insufficient e.g. searching of missing people.

Vapepa is an organization of different societies like first-aid groups, off-road clubs, hunting societies, service dog clubs, search and rescue teams etc. Individual can be a member of Vapepa via being a member of these societies. Vapepa is working by Bring Your Own - principle.

Members of different societies are volunteered and they are committed to be a member of alert groups. Of course the taking part to the operations is non-compulsory. The possible operations are regularly practiced.

The searching operation is always lead by police and the field leader of Vapepa is giving an assistance to the police. Vapepa field leader has to know the situation on the field, where different teams are searching, what they possible have found on the field and are the clues relevant to the operation. The operation lead has to know the true location of teams and the possible clues immediately, especially if there is a life-saving operation on the run.

Handheld GNSS receivers are coming more common and most of the smart phones include the positioning feature. Volunteers are using devices in rehearsals and operations. Because of the most volunteers are layman of positioning they have no knowledge and experience of using the device, nor do they recognize its limitations

To help the gaining the up-to-date and correct data from the field mr. Sami Heinonen has developed an application to gain the GIS data from field via smart phones. For users is developed an easy-to-use smart phone application to gain GIS data to operation lead Application is a very good example of volunteered geographical information, VGI. The program is almost ready for use in operations.

For the alert groups of Oulu region the author of this paper has given training and lessons of positioning and the reliability of devices. The aim of the lessons has been to give the more realistic judgment of devices and the limitation of positioning systems, such as the different error causes.

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## 1. INTRODUCTION

About 2000 persons are missing in Finland every year. Some of the missing people want to vanish for some reason, some just get lost and an increasing trend is memory disease patients. When someone is missing and peoples can't find the missing person by themselves, they need help. In first place the police is responsible of searching people but if the missing person is a child, a geriatric or the weather conditions are difficult, police alert volunteers to help searching.

In the operations the positioning is necessary when having the general view of operation. This is also one element of successful operation. The positioning is made by laymen who has no professional background of positioning

## 2. VOLUNTARY RESCUE SERVICE, VAPAAEHTOINEN PELASTUSPALVELU (VAPEPA)



*Lähimmäisen apuna - viranomaisen tukena / Helping neighbor - supporting authorities*

The purpose of Voluntary Rescue Service is to help public authority (e.g. police) in cases where the resources of authority are insufficient e.g. searching of missing people. Finnish Voluntary Rescue Service is an organization coordinated by Finnish Red Cross, Finnish Lifeboat Institution and Finnish Air Rescue Society. Under the umbrella society is regional committees, which coordinates the preparedness regionally.

Vapepa is an organization of different societies like first-aid groups, off-road clubs, hunting societies, service dog clubs, search and rescue teams etc. Individual person can be a member of Vapepa via being a member of these societies.

Members of different societies are volunteered and they are committed to be a member of alert groups. Of course the taking part to operations is non-compulsory. The possible operations are regularly practiced.

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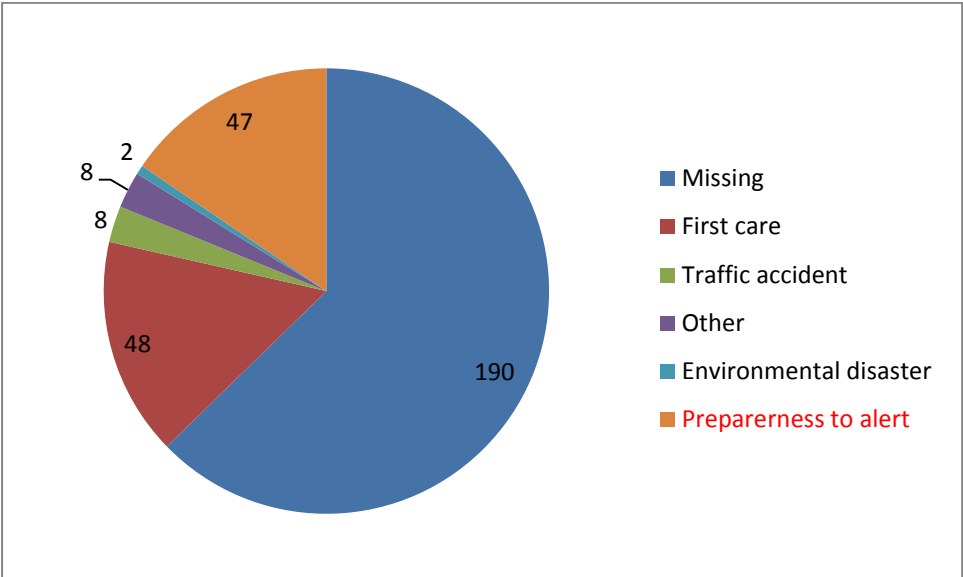
Vapepa was established in year 1964. Several years before the lack of searching organization was noticed and announced to the authors. The last push to establish the searching organization was the disappearing of five-years-old girl in Lapland on May 1963. The girl went missing during normal day from her own home yard. At first the villagers tried to find her and after a couple of hours searching they called local police to help. In couple of days there was couple of thousand volunteers searching the little girl from boundless taiga. There were also airplanes and helicopters trying to find the girl from above. After 14 days searching the girl was found drowned ca. 40 km distance from her home. It was estimated that the girl had walked totally 80 kilometers during 14 days.

This was the trigger and Finnish Red Cross made a proposal to authorities to have an organization to support authorities especially in searching. With 50 years of experience Vapepa is supporting authorities e.g. in large evacuations, first phase care, traffic controlling and property savings. Searching is the most common operation.

At the moment Vapepa has ca. 1300 alert squads and 22 000 volunteers.

### 2.1 Operations

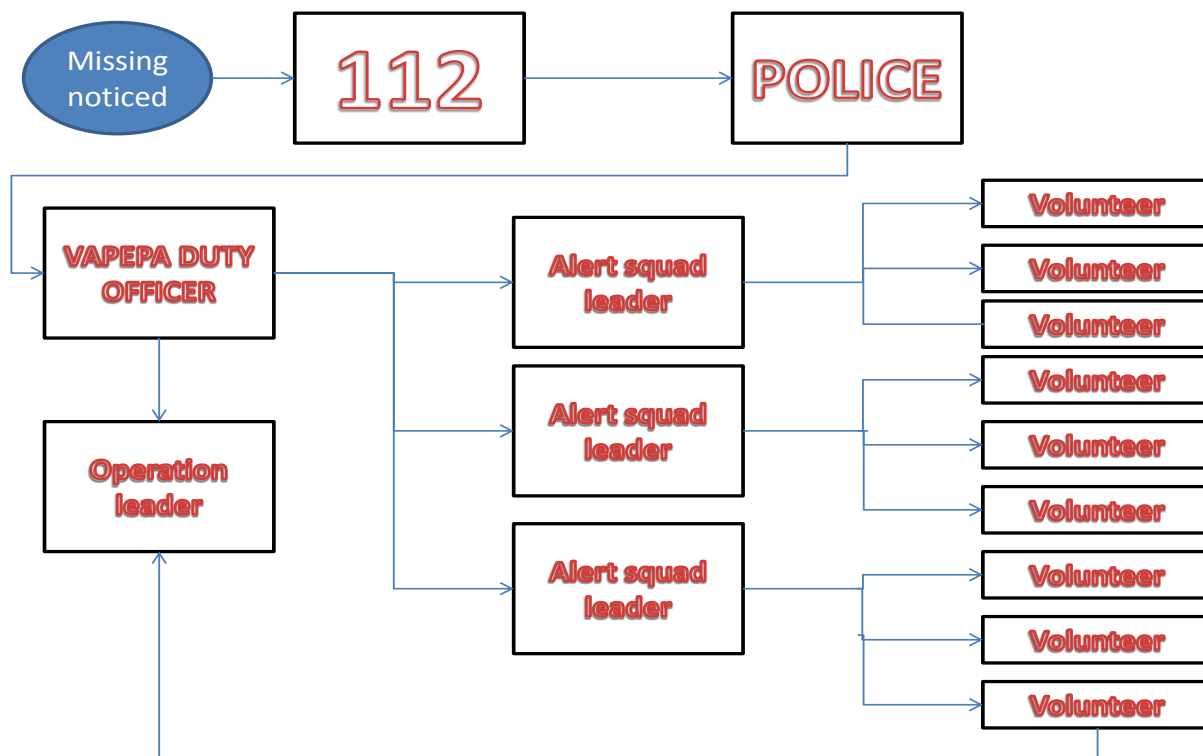
Vapepa was alerted 303 times and helped 818 persons in Finland in year 2013. In same year there were 53 trainings, and total 5534 volunteers attended to operations. Main focus was on searching operations but first care -tasks are increasing. In this paper term first care includes the supporting people under emergency situations such as fire and when searching a missing person. The first care supports authorities by supporting people and taking care of their basic needs.



Vapepa operations in year 2013

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#### Alert chart of searching operation

In searching operations the police is the responsible. Police delegates the lead of volunteers to the Vapepa operation leader in cases where the resources of police are insufficient. Police is needed to go to other urgent operations sometimes. The verge alert Vapepa is lower when the missing person is a child or geriatric, if it is possible the person has had bout of illness or the person has become criminally offended. Then the searching is life saving operation. Police can order every 18-54 years old citizen to help searching and life saving operations according by the law.

When the volunteer is alerted, he has to go to the leading point and report to the operation leader. Leader or ordered volunteer formulates volunteers in searching teams and gives the tasks to the ordered team leader. It has to be noted, that in most cases the volunteers are not trained members of the alert squads. They could be the relatives of missing person, neighbors or villagers. For this group it is given a short introducing and training to search and an experienced alert squad volunteer is ordered to be the team leader.

The communications between team and the operation leader is maintained by walkie-talkies and if there is a need to encrypt the message, then a mobile phone or messenger has to be used. This is necessary when the message is concerning changes in team personnel or the team has found the missing person.

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The traditional way of searching is to form the searchers to a chain and an individual searcher has to see the feet of the neighbor searcher. The velocity of the searching chain is rather slow because the purpose of searching is to find the missing person or items belonging. This method is very accurate, even smaller item is possible to find from forest. One chain could have 10-20 volunteers.

One incoming method is Managing Search Operation (MSO). The searching starts with profiling the missing person: has the person gone missing before, what could be the most possible locations where he/she could be found. Also the known diseases should be taken in account, because these can affect to the behavior of the missing person.

In MSO the searching team consists of three volunteers. They search the ordered area quickly, and then move to another area. In this method the positioning and parceled maps are in big role. More of the map parceling later in the text.

Searching is started nearby the last known location of the missing person. The range of searching area is max 300 meters around the missing point before the rescue dogs have sniffed the possible tracks of the missing. Of course in this phase the patrols by cars or by foot have to be sent to check roads and estimated routes the missing person could be using.

After the dogs have sniffed the area around missing point and if they have not marked anything the searching areas will expand further and in areas where the possible clues could have found. In longer searching operations the amount of volunteers could increase remarkable high, the operation could take several days and the searching area will expand.

In most cases the missing person has been found less than a kilometer distance from home or from the last known place.

The searching will end if the missing person is found or if the police ends the searching. In some cases volunteers are still searching missing person after ending, but these searches have no official status.

Volunteers are possible to get debriefing after operations.

## **2.2 Being a volunteer**

To become of a volunteer of the Vapepa is very easy. Joining to any alert squad and being a member of it opens the doors to operations. Of course all the skills needed in operations, like orienteering, are helping the readiness. Alert squads and Vapepa regional organization will train you to searching. It is everyone's own choice how active member of the squad you want to be. Some are just waiting for the call to operations and some other is taking more active role in association.

When a volunteer has committed to being a member of alert squad it is good to have the devices needed in operations packed and ready to take with you in no time. All the equipment has to purchase by the volunteer. You don't have to be on readiness 24/7/365 and attendance to operations is always voluntary. During the operation you can leave the searching whenever you want and you can refuse searching if it is obvious that the missing person is deceased.



One possible gear of the volunteer

Being a volunteer is giving a great opportunity to give your personal skills to helping people, having a very useful hobby and getting to know people with different backgrounds. You can train yourself in different tasks depending your interests and hobbies, e.g. communication, searching, leading, transporting, rescue dog activities, first aid etc.

### 3. POSITIONING IN VAPEPA

Vapepa has published instructions to positioning, GNSS receivers and coordinate systems in year 2009.

Instructions include a theory of a different map datum, different coordinate systems and how to set up GNSS -device to show needed coordinates. The most used coordinates are WGS84

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geographical coordinates and the instructions also explain maps using the Finnish national grid. The only introduced system is GPS.

Land Survey of Finland changed coordinate system from national grid to ETRS-89 system in year 2010 and since then the printed maps have used ETRS-TM35FIN coordinate system. Instructions do not tell about the using GNSS-device, the theory of satellite aided positioning or even what could cause errors to the given location. This information could be very useful to the non-professional-land-surveyor-volunteer when trying to estimate the errors and reliability of the position given by device. Instructions need also updating about used coordinate systems and how to make device show TM35FIN coordinates. This will help a lot when operating with printed maps and when the device is giving very same coordinates as the map is using.

Need of the updating is urgent because the number of GNSS devices is increasing and as those are operated by non-professionals.

### **3.1 Positioning in alert squads**

To operation leader it is vital to know the location of all searching teams to be able to lead the searching to relevant areas. Searching team has to know the correct location when navigating to the ordered searching area and if there is something to report to the operation leader e.g. found items or the target person.

Traditionally the positioning is made by maps and compass but number of electronic devices has risen last years. During the operation there are several handheld GNSS receivers on the field. Devices are used in navigation and in searching to locate the edge of earlier searching line. The location is transmitted from team to leader via walkie-talkies or mobile phone orally. Sometimes the SMS is used.

Because most of the volunteers are layman in positioning they trust to devices too much and they have no knowledge of errors or the different factors causing those. To remove the gap in alert squads in Oulu area has given the training to positioning and using of devices. The main message from the trainings has been that the GNSS receivers are very good to assist searching but only when understanding the limits of the device and when the errors are estimated correctly. Volunteers still need to have the skills to orienteer and to locate themselves by paper map.

### **3.2 Vapepa-Tutka**

The great example of Vapepa Bring-Your-Own principle and volunteered geographic information is GIS -portal named as Vapepa-Tutka. The system includes web-based operation map (including e.g. terrain maps, weather and rain etc. relevant information which could affect the operation) and application to smart phones.

The creator of Vapepa-tutka, Mr Sami Heinonen, once noticed voluntary searchers near his summerhouse and he decided to develop a system to help the operation leader to have the big picture of the operation. He made the system as a volunteer and he got no compensation

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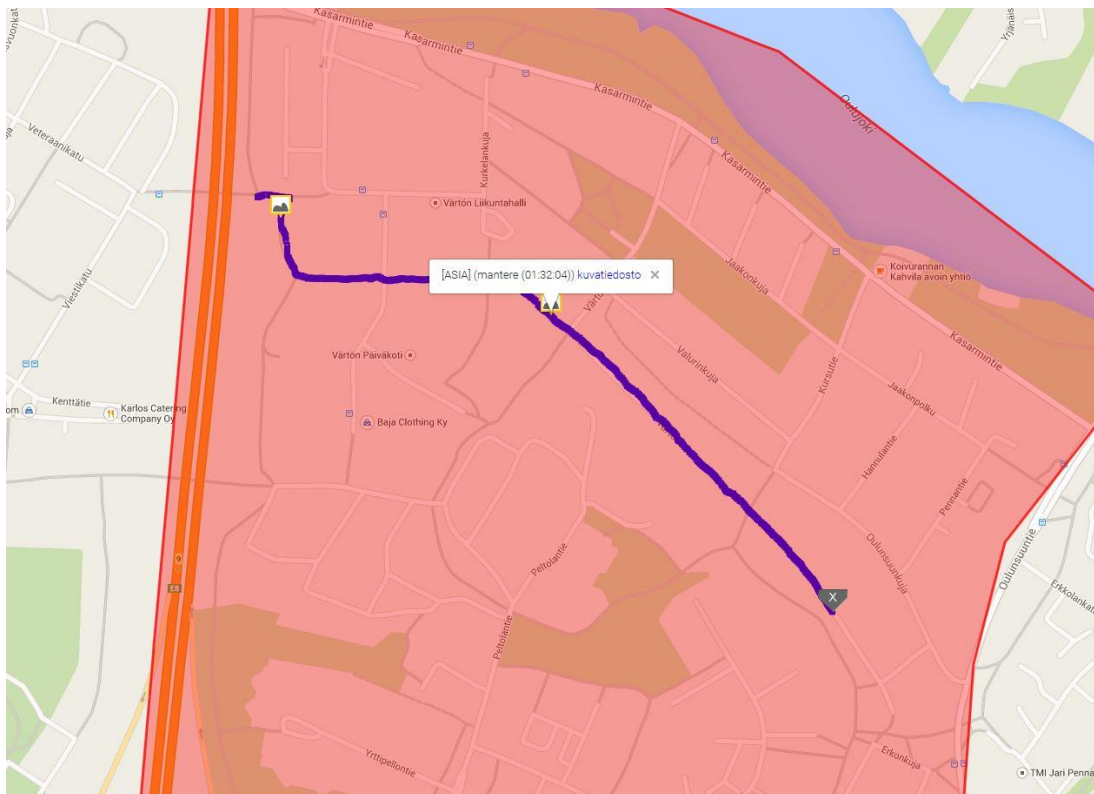
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about his work. Mr. Heinonen is not a land surveyor but he has experience about positioning and programming.

The tool is very useful when an up to date GIS -data from the field is needed in real time. To the location is possible to attach the subject of the sent coordinates and a photograph of the object found on the field. This reduces the possible misunderstanding which is possible when describing the location and object orally.

From web portal the leader of operation is possible to see the location of different teams in real time and receive the data sent from the field. Operation leader creates a new operation and specifies the notes of the missing person and the operation area. The system will name the operation automatically.

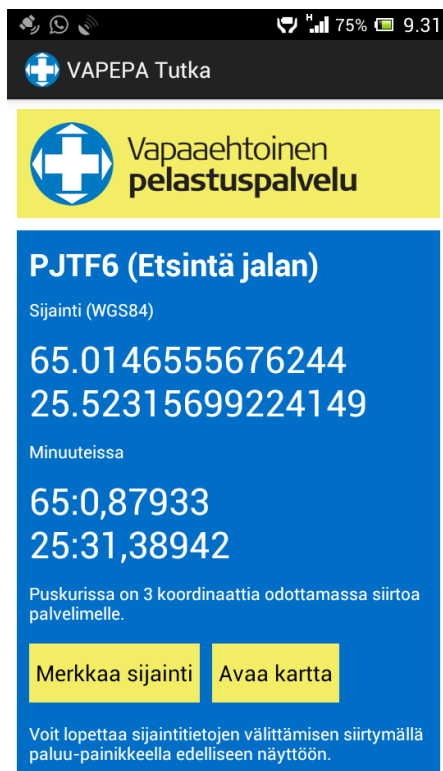


An example of the operation area

All the searching team has to do, is to activate the positioning from smart phone, specify the operation and location refreshing rate and then put the phone back to the pocket. The application will send the location automatically and manual position is needed only when marking certain location or sending a picture to the server.



Vapepa-Tutka has not been on operations yet, it is under testing and construction; volunteers are testing system and giving the experiences and suggestions to Mr. Heinonen. The system has been used in some training lessons.



An example of the operating screen of smartphone application

After all the system is working quite well and has a potential to become very important tool of the operation leading. Especially when operating on urban areas with a huge amount of teams having the big picture of situation is easier with Vapepa-Tutka. One good option would be the production of MSO-parcels inside the Vapepa-Tutka and those maps would be sent to the field.

The weakest link in the system is the used technology: the devices need power and the batteries of smart phones are insufficient especially when operating in cold temperatures. The battery recharging is impossible and sometimes the mobile internet connection is nonexistent when operating in rural areas.

### 3.3 Maps to the operation area ASAP

Rapid start of the searching is absolutely necessary, if the missing person is a child or a geriatric and in the situations where a person is assumed to be in life danger or injured.

There are still some factors which can cause the delays to the starting and one is the lack of maps of the operation area. Normally the maps have arrived within one or two hours to the

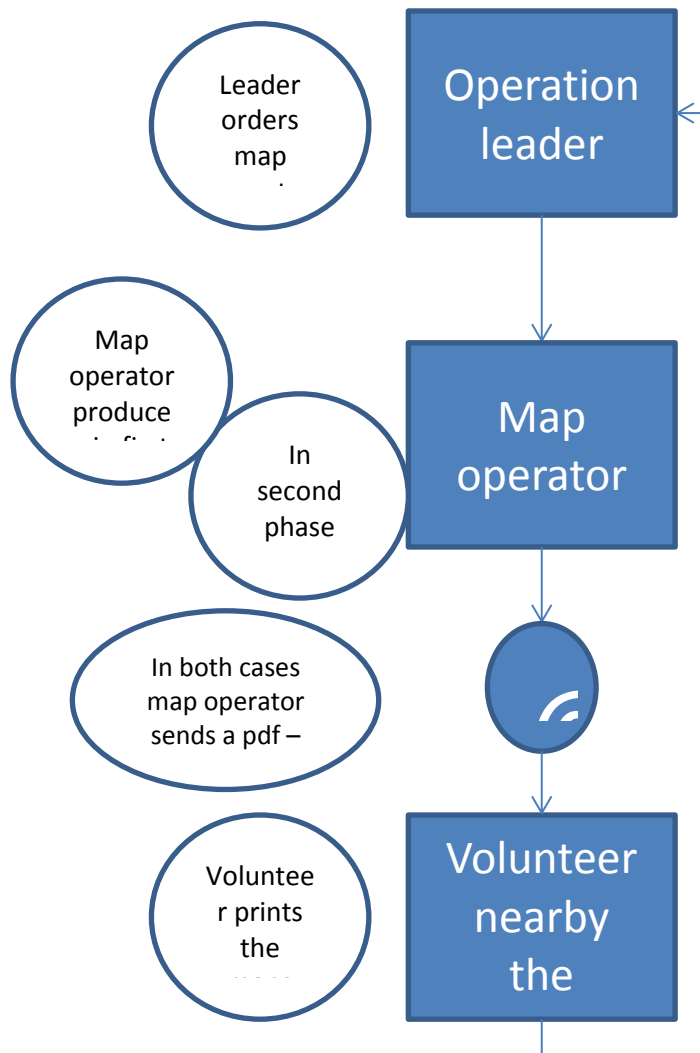
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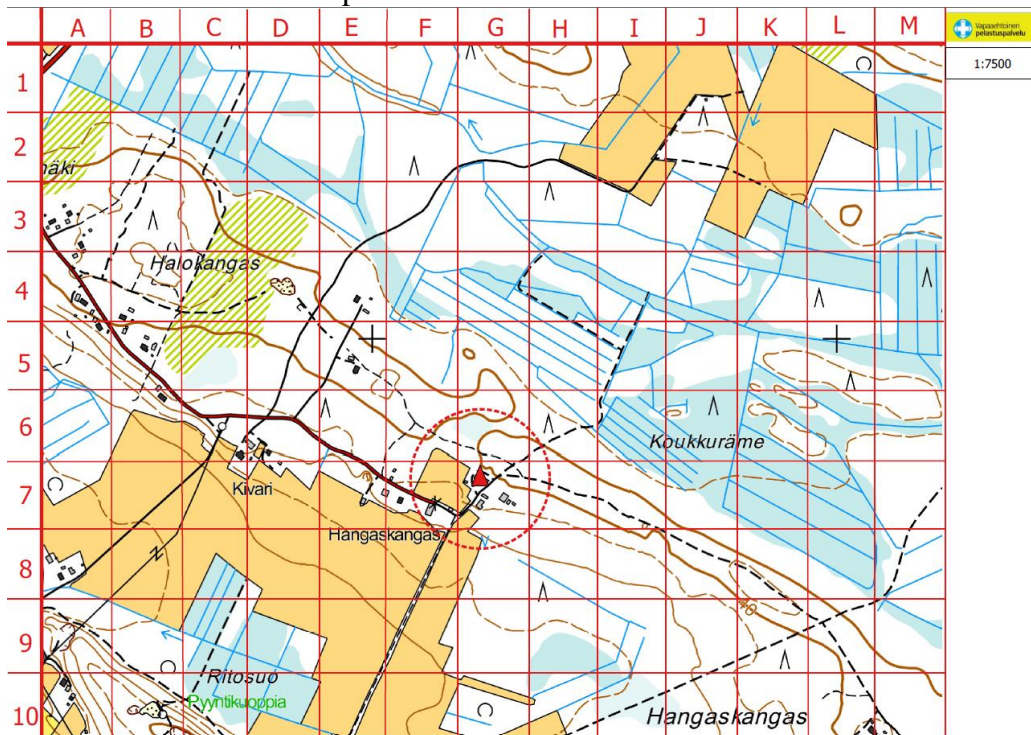
operation leader, but in some cases the delay is too much. One solution to avoid the delay is to start the searching nearby by using concept maps e.g. sending one team to north and another team to west max. 300 meters. This is very useful, when volunteers are arriving to the leading position little by little.

The concept map does not support planned searching. Leader has to always know where the teams are in the field and if they have found some clues etc. relevant to the missing person. To avoid the lack of updated maps the actives of SAR-Oulu (Search And Rescue association) have developed a system to produce maps of the operation area in no time. Author of this paper has been a responsible for the technical execution.

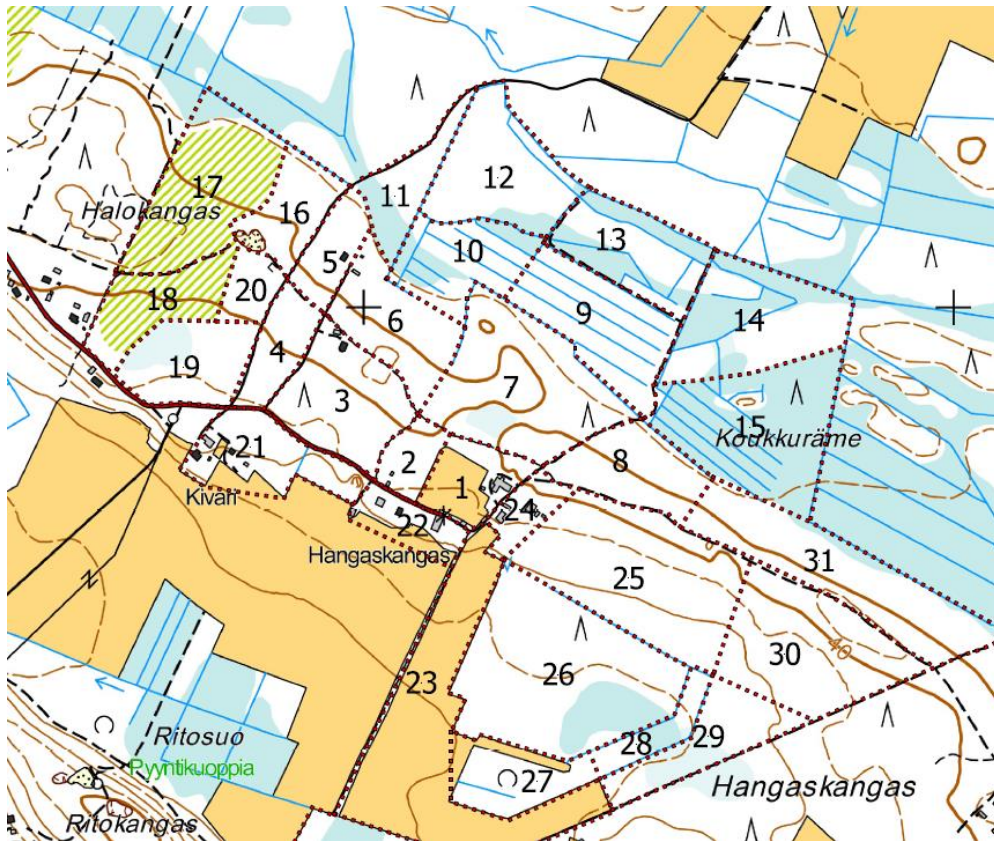


Time estimation of order to the physical map on the operation area is depending of the distance of the volunteer printing the maps and the operation area. Estimated time is less than an hour of the first phase map from order to the delivery to the operation leader. The first version of MSO -parceled maps are possible to have on the operation field in less than two hours.

The most effective and fastest way to achieve the fully functioning system is to adapt the existing program and the existing data. Map production is made by open GIS program QGIS and the used map data is National Land Survey of Finland's open data 1:25 000 raster map. The next version will be operated with vector data.



An example of first phase map. The red triangle is the last known location of missing person and the diameter of the circle is 300 m.



An example of second phase MSO -parceled map.

Practice on the field has shown that the paper maps are more reliable than electronic devices, especially when operating in cold temperatures. The applications developed to smart phones are very useful, but the battery of the device is the weakest link. Recharging is not possible in most cases. Handheld GNSS receivers are also good supportive devices, but you can't upload the MSO-parceled operation maps to the devices. Those are very useful when finding the ordered searching area.

In future scenarios, if the developed operation-map-production procedure is noted workable, it could be covering the area of Oulu region. Then we have to think how many duty officers are needed to maintain the readiness to secure the map production to the operations.

## 4. CONCLUSIONS

Operating 51 years the Vapepa has become very important assistant to different authorities. The volunteers are very motivated persons in helping and training the different operations.

The positioning in operations is a very important sector and especially in searching. Having the big picture of operation and teams locations aids the operations become successful e.g. finding the missing person as soon as possible. The positioning is need to be correct and the devices and developed systems reduce the unsuccessful communication and false locations.

Vapepa should encourage alert squads to use GNSS -devices and update the positioning instructions respond the year 2015. Especially the general principles operating with GNSS -device and different causes of false positioning would be good to introduce to the non-professional volunteers. Also using the ETRS-TM35FIN coordinates for positioning is very useful when operating with paper maps and GNSS-devices.

Vapepa-Tutka is a very good tool for having the big picture of the operation and having up-to-date GIS data from the field. It helps to focus the resources to relevant areas. The system has been developed easy to use, is brilliant and is a very good example of VGI. Yet, it still has a long way to become the main tool of operations and one obstacle is the limitations of used technology.

The paper map is still most reliable when operating on the field and especially in cold temperatures. The only roadblock to start the systematical operation is having the physical maps from the map storage to the operation area; sometimes this would take several hours and in life saving operations the delay can be lethal. For this reason to speed up the searching the maps should be designed to the operations and then send the file to be printed nearby the operation area. This may save hours and might give more time to the ongoing operation. This system is still under construction and tested locally. One good option would be prepare MSO-parceled maps from possible missing areas e.g. nursing-homes. This increases the preparedness and will give more speed to start the searching.

## REFERENCES

Website [www.vapepa.fi](http://www.vapepa.fi)

Interviews of Mr. Sami Heinonen and Mr. Kimmo Rannanjärvi

## BIOGRAPHICAL NOTES

Author is working as a cadastral surveyor for National Land Survey of Finland and he has been a volunteer in alert squad and first-aid squad since 2013.

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