

Testing French BMS, FINDERS

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English summary

In FFI-project 1019, “TEKNISK”, we aim to advise the Norwegian Army on what functionality they should require from a future Battlefield Management System (BMS). The French Army will be using a BMS called FINDERS, developed by NEXTER (formerly GIAT) We have been testing FINDERS to examine its functionality and user friendliness, and make an assessment as to how FINDERS can help tank commanders execute their tasks. Apart from studying FINDERS and playing with its various menus, we have connected FINDERS to a simulator in order to test it in simulated scenarios. We have played several test scenarios, and also had one day where officers from the Norwegian Army played several scenarios with us, and gave us their feedback on the system and its functionality.

Sammendrag

I FFI-prosjekt 1019, TEKNISK, ønsker vi å gi råd til det norske Forsvaret angående hvilke krav de bør sette til funksjonalitet i et fremtidig BMS (Battlefield Management System). Den franske Hæren bruker et BMS et FINDERS, som er utviklet av NEXTER (tidligere GIAT). Vi har i prosjektet testet FINDERS og vurdert funksjoner og brukervennlighet, og evaluert hvordan og i hvor stor grad FINDERS kan hjelpe vognkommandører med å gjennomføre sine oppdrag. I tillegg til å undersøke FINDERS og prøve de forskjellige menyene, har vi koplet FINDERS til en simulator for å kunne prøve den i et simulert miljø. Vi har spilt flere mindre scenarioer. Vi satte også av en dag der offiserer fra den norske Hæren kom og spilte flere scenarioer, og ga tilbakemelding på deres opplevelse av FINDERS og funksjonaliteten de fikk prøve.

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1 Background

1.1 BMS in Norway

For several years, the Norwegian Army has been testing Battlefield Management Systems (BMS) in exercises and with deployed forces. Kongsberg's NORTaC BMS has been chosen as an interim solution. After the interim period it is, however, not decided what system will be procured, nor precisely what functionality will be required from such a system.

The Norwegian Army's CCIS (Command, Control and Information System) on tactical level is called NORTaC CCIS. This is developed by Kongsberg. Based on this CCIS, Kongsberg has also developed the BMS which in this document is referred to as NORTaC BMS.

NORTaC BMS has blue force tracking, ORBAT (ORDER of BATtle), LOS-calculations (LOS=Line Of Sight) and options for adding observations. The MRR (Multi Role Radio) is used for communication, and positions of own units are updated typically every five seconds. NORTaC BMS is continuously being improved and updated.

NORTaC BMS has been tested in the Norwegian Army during several winter exercises, and has also been deployed with Norwegian forces in international operations.

1.2 BMS in Project 1019 TEKNISK

TEKNISK is an FFI-project dealing with future technologies for combat vehicles. One task in this project is to study BMS, in order to be an advisor for the Norwegian Army in their future procurement of such systems.

In project TEKNISK, we have developed our own BMS for testing and experimentation. This system is not designed to be fielded; rather the idea has been to develop a tool for fast and easy implementation of new functionality for evaluation and demonstration purposes.

This BMS displays positions of own units, along with the direction of their chassis and turrets. Observations and simple graphics can be added. The traversed route of each vehicle can be shown. Combined with the simulator, some information (positions of own forces and observations) can also be shown on the simulator screen by using a technique called Augmented Reality (AR). Various functions will be implemented for later experiments.

The BMS is meant for lab testing, and the update frequency of friendly positions can be configured (commonly set to twice every second).

1.3 The Simulator

In project TEKNISK we have developed a simulator for testing and experimenting with BMS. This simulator is based on the commercial game Unreal Tournament 2004, and is modified with suitable vehicles, effects and terrain to meet our needs.

A BMS can easily be connected to the simulator, which will feed the BMS with data that normally would be provided by a real vehicle, like position, heading, turret direction, sensor data and more.

In the simulator, friendly and enemy vehicles can be operated. The maps in which the simulation takes place are taken from real areas in Norway or other parts of the world. As this is not meant to be a driving or firing simulator, vehicle controls are greatly simplified. Nevertheless, it is an effective tool for demonstrating various capabilities, like a BMS, and for training communication and procedures.

1.4 Why examine FINDERS

One of the objectives in project TEKNISK is to help the Norwegian Army set requirements for BMS, so as to help them find the best system for their needs. It is therefore important for us to learn as much as possible about existing and emerging BMS worldwide.

Accordingly, the opportunity to examine various BMS, like FINDERS, is of great value to us and is very much appreciated. Upon learning about FINDERS, FFI and NEXTER agreed that both parties would benefit from FFI testing and evaluating FINDERS, reporting to NEXTER (this report) on our findings. Hence, NEXTER provided FFI with two copies of the FINDERS software for installation on computers at FFI's battle lab.

2 Quick overview of FINDERS

FINDERS is a BMS developed by NEXTER, formerly GIAT. It is in service in the French Army, who uses it in combination with the PR4G radio. With this radio, position updates are broadcasted once every 30 seconds. Other radios could be used as well. In addition to blue force tracking, which means that the position and heading of all units connected to the BMS are shown on the map, FINDERS has several options for sending or requesting various information.

FINDERS is not primarily meant as a tool during actual engagement; in this phase, the vehicle crew is expected to be too busy with other tasks to pay much attention to the BMS. Rather, it is developed as a tool for the planning and reporting phases of an operation, and is also useful when manoeuvring.

Several layers containing various information can be turned on and off in FINDERS. Such layers include information about own units, navigation graphics, information about enemy observations and other helpful information.

FINDERS is tailored to meet the requirements of the French army. The idea is that anyone procuring FINDERS should have it adapted to meet their specific needs. Accordingly, the FINDERS version procured by another nation will not be identical to the FINDERS version used by the French army, which naturally is the version we tested.

Sending messages is done through a menu system. There is one form that has to be filled out for each type of message. These forms are designed so that communication procedures are as close to existing (pre-BMS) procedures as possible.

3 Tests

3.1 Setup

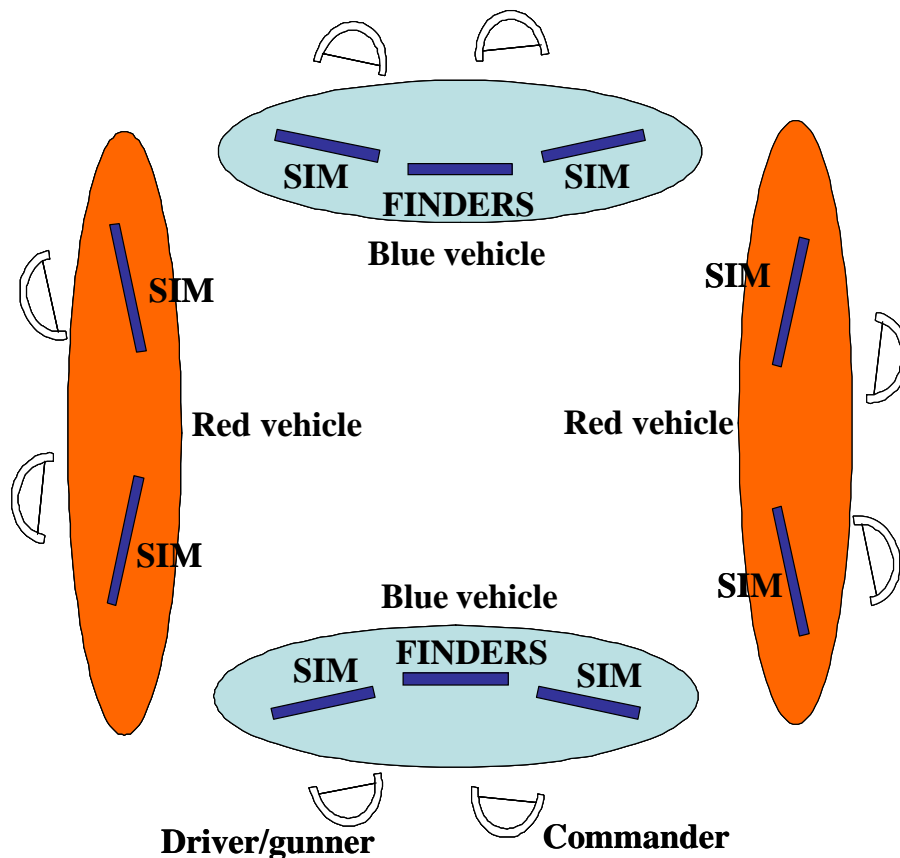


Figure 3.1 Setup during experiment

We connected FINDERS to our simulator. We had two FINDERS computers, and one simulated vehicle connected to each FINDERS computer. Connecting FINDERS to the simulator went well, and it operated as expected. Positions, headings and turret directions were transmitted from the simulator and displayed on FINDERS.

In addition to the two simulated vehicles using FINDERS, we had two simulated vehicles operating as the enemy. Each simulated vehicle is normally operated by two persons, one taking the role of the vehicle commander, and the other taking the roles of driver and gunner. Since the vehicles on red side did not use a BMS, and there only were two vehicles, we operated the red vehicles with one person only.

3.2 Limitations

At first we just played around with the system, examining the possibilities in FINDERS, and learning to understand and operate all the functionality available. This gave us a rather good impression of what the system can do, and what were the most helpful functions. However, we would also like to test FINDERS in a simulated exercise, both in order to see how it would perform under such an exercise, and to show the system to officers in the Norwegian Army.

May 9th 2007 we planned an experiment where eight soldiers should come to help us test FINDERS in a simulated exercise. However, due to unforeseen events in the Army, only two officers were available for the tests. This greatly hampered the experiment, but we had no choice but to carry it through with the officers available.

The officers took the roles of vehicle commanders in the two vehicles connected to FINDERS, whereas scientists from project TEKNISK had to take the roles of drivers/gunners, and also handle enemy units. For this reason, the vehicles were operated in a less realistic way than we had aimed for.

In order to play as many scenarios as possible, each scenario had just a short introductory phase before contact with enemy units. The simulated scenarios were conducted within a limited area, and lasted for typically 15-20 minutes. Manoeuvring to the area of interest was a limited part of the scenarios, and since we had no “higher level”, reporting up to headquarters or receiving updated information and/or orders during the exercises could not be tested. Consequently, we were mainly able to test functions which are of importance just before, and during, contact with the enemy. However, other functionality was demonstrated for the officers, and we discussed this functionality with them as well, although this of course is not the same as actually testing it in a simulated exercise.

3.3 Scenarios

As only one common map was available in FINDERS and our simulator, all scenarios took place in the same geographical area, namely at Rena in Norway. This did not put notable restrictions on us, as the 6 km by 6 km area was large enough for sufficient variations in terrain, and we were only interested in evaluating the functions and user interface of FINDERS, not in the actual outcome of each scenario, nor in testing various tactics.

Due primarily to limited personnel available for the tests, all scenarios had to be played with only two vehicles on Blue side, and two vehicles on Red side. Two vehicles are sufficient for testing some of the functionality in a BMS, but much of the available functionality in FINDERS adds far more operational value when more units are involved.

Red and Blue forces had different missions in the scenarios. Blue were sometimes supposed to clear an area, sometimes to observe a sector and report enemy activity, and sometimes just to patrol a route. Red had varying degree of hostility towards Blue, and would sometimes attack them on sight, and sometimes only respond when provoked in some way.

3.4 Carrying out the Exercise

Before executing the scenarios, the two officers involved in the exercise were introduced to FINDERS and were given a short training. They also got a very short training in using the simulator (which is very intuitive; hardly any training is necessary to use the simulator).

Prior to each scenario, the officers laid their plans and displayed planned routes in FINDERS. During the execution of the scenarios, the officers functioned as vehicle commanders in the Blue vehicles, and also operated FINDERS. Two scientists from project TEKNISK took the roles as gunners/drivers, and two others handled Red forces. As mentioned earlier, we had planned to use eight officers/soldiers for the exercise, but in the last minute, something came up, and the Army support was reduced to two officers.

Each scenario lasted for approximately twenty minutes (in addition to the planning phase), although some took less and some took more time. The officers got to try some of FINDERS functionality, and commented on how it helped them in executing their tasks and also on what they did and did not like about the system. These comments, along with our own experience with the system, are the basis for our evaluation as described in the following chapter.

4 EvaluAtion of FINDERS

4.1 Functions in the Main Menu

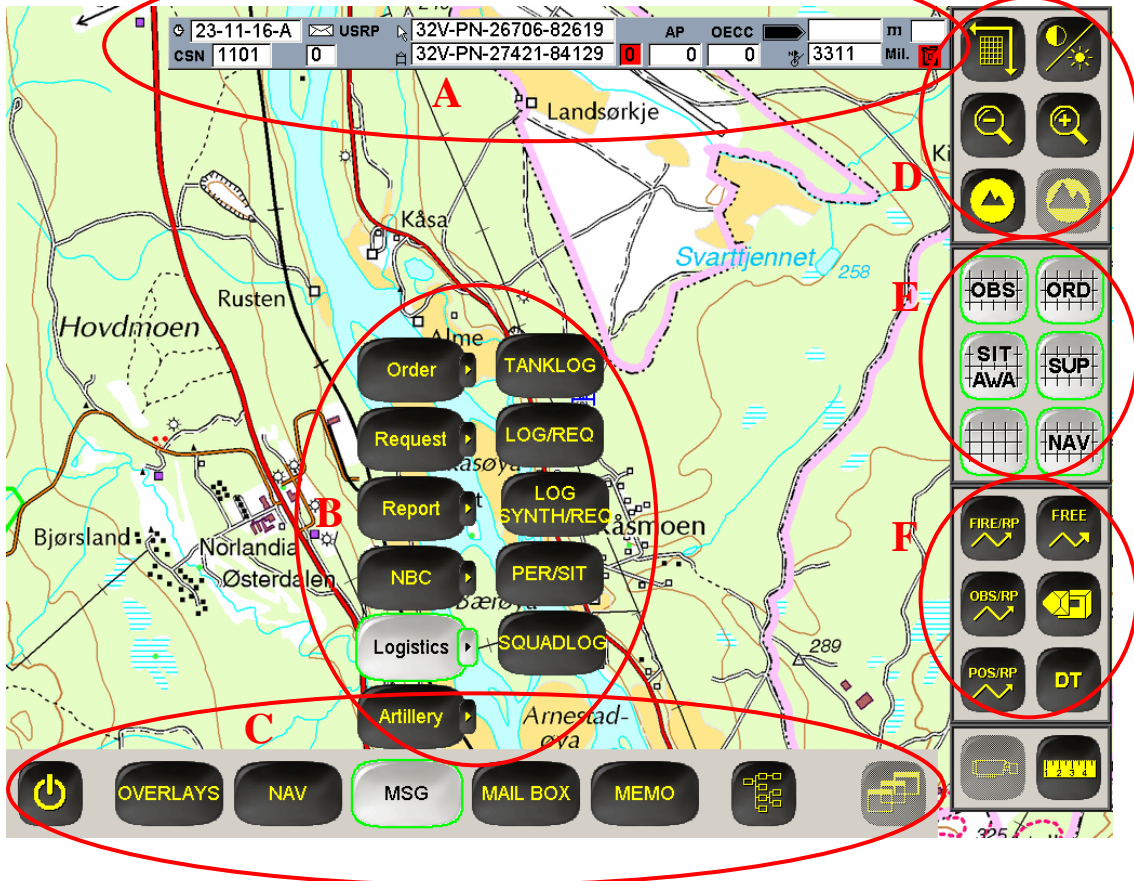


Figure 4.1 Main screen of FINDERS

Figure 4.1 displays the main screen or “front page” of FINDERS. The various elements are as follows:

1. Information header
2. Drop-down (drop-up?) menu and submenu. This is opened from the main menu
3. Main menu
4. Zoom, pan and brightness
5. Shortcut for overlays
6. Shortcut for most used messages and mail

In the information header, information such as own identity, position and connection status is displayed. Clicking on this header causes the screen to go black, a useful feature if you quickly

want to reduce “light pollution”. Clicking again brings back the normal display, but one has to click **within the header**, which is unfortunate, as one can no longer see the header.

The main menu has five buttons which each opens a separate submenu: “Overlays”, “Nav”, “Msg”, “Mail Box” and “Memo”. The submenu “Overlays” lets you configure the various overlays and decide what should be displayed on the screen. “Nav” (Navigation) allows for entering and altering routes. “Msg” (Messages) has the drop-down menu 2 shown in Figure 4.1.

The drop-down menus (or should we say drop-up menus?) with submenus feel intuitive, and give room for many functions without blocking too much of the map. It requires a few more clicks than having direct access to all functions, but the way FINDERS should be used, that probably doesn’t matter much.

The “Msg” drop-down menu from the main menu has six options, all with submenus. This is the only menu selection with an additional layer of submenus. This allows for many, yet very specified and rigid, messages to be available. See for example Figure 4.2. Fewer and more flexible options would probably be preferable. Most likely, this is very easy to configure to suit the needs of the potential users. “Mail box” opens the mail box. Sending messages will be discussed further in chapter 4.2.

Report - Tact Situation - SIT/REP5
181324A - 00001101

Unit location | Unit activity | Enemy situation | Enemy destruction

Platoon 1
P1₁ → [Map Icon]
Observer position [Red Box] [Grid Icon]
Hectometric UTM
Direction [Red Box] Mil.

Platoon 2
P2₁ → [Map Icon]
Observer position [Red Box] [Grid Icon]
Hectometric UTM
Direction [Red Box] Mil.

Platoon 3
P3₁ → [Map Icon]
Observer position [Red Box] [Grid Icon]
Hectometric UTM
Direction [Red Box] Mil.

Platoon 4
PA₁ → [Map Icon]
Observer position [Red Box] [Grid Icon]
Hectometric UTM
Direction [Red Box] Mil.

CP
PC ↓
Observer position [Red Box] [Grid Icon]
Hectometric UTM

Recipients | Send | File | Cancel

Figure 4.2 Form for sending situation report

On the right hand side of the screen, there are several shortcuts. There are shortcuts to turn on/off each layer, and also a shortcut for mail and the most used messages. This is a good feature. It makes it faster and easier to access the most used options. Furthermore, the shortcuts for the various layers are highlighted when selected, and dark when not selected. This makes it very easy to determine which layers are turned on, and which are not.

4.2 Messages in FINDERS

There are several types of messages that can be sent in FINDERS. Orders and reports were the ones we ended up using most frequently, probably at least partially due to the fact that we had no higher level (and thus no supporting units either). When sending a message in FINDERS, one has to fill in a form which is specific for the type of message that is to be sent. In some cases, some information is filled in automatically, whereas other information has to be provided by the user, some of it mandatory, some of it optional. One can also specify the receivers of the message. Figure 4.3 shows the menu for sending information on an observation. It is mandatory to fill in the “nature” (type) of the observation, the number of observed entities, the location and the “observation sector”, which is the sector where the observer was looking when making the observation. Red fields are mandatory, whereas orange fields are optional. Optional fields are “Type” (which is a specification of “Nature”), Direction and additional information.

Although it is relatively easy to create and send messages, one has to go through menus and insert information which is often not relevant. Also, the system feels rather “rigid”, in the sense that one has to do everything in one particular way. As mentioned earlier, this is due to the French Army’s desire to keep everything as similar to previous procedures for communication as possible, partly because this is how officers and soldiers are trained. This has probably not been an issue because FINDERS primarily is meant to be used in situations and phases when one has the time to fill in details in forms, and not so much in situations where every second counts. Still, we find it to be unnecessarily rigid and time consuming.

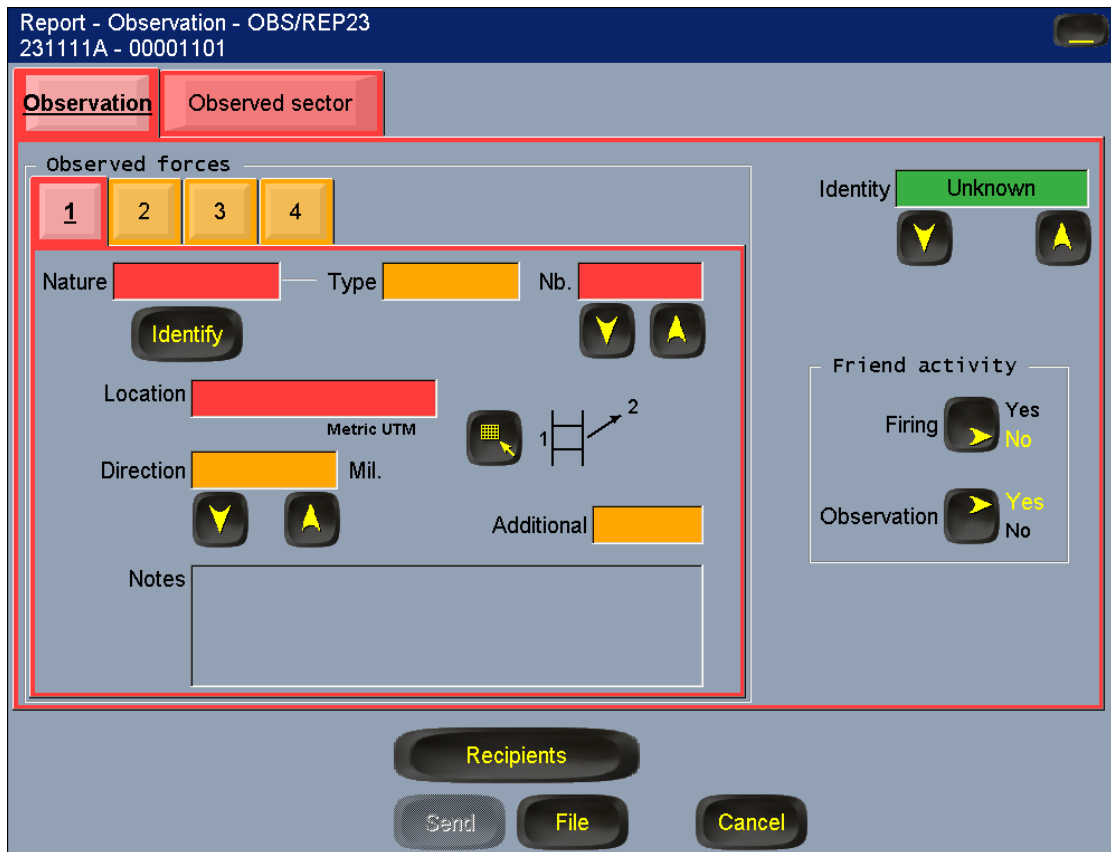


Figure 4.3 Menu for sending observations

4.3 Communications

We did experience some communication problems during our testing. However, we were told that this was due to the fact that we were not using real radios, but applied a LAN and just simulated the radios. There is no reason to believe that the system in a real environment will not communicate well and without these problems (of course there are other challenges with communication in the real world, but that is not an issue for this report).

The French army uses the PR4G radio for communication in FINDERS. We were ensured that other radios can be used as well. With the PR4G radio, FINDERS can update the positions of friends about once every 30 seconds. This strengthens our impression that FINDERS is not designed for the engagement phase, which was also confirmed by the manufacturers. Such update frequencies are OK in planning and reporting phases. It is probably also acceptable in transportation phases, when one is manoeuvring through safe areas, although a higher update frequency may sometimes be useful also in such cases. Anyway, with a different radio, like the MRR, it may be possible to increase the update frequency of FINDERS, which could be of importance for potential customers.

4.4 Maps and Map Functionality

The tested version of FINDERS had 2D-maps only. Zooming and panning is executed through buttons in the upper right part of the screen. This worked very well. The maps could easily have been replaced with other types of map, like a satellite image. The Rena map was made available to NEXTER prior to our tests, and it all worked very well when we connected FINDERS to our simulator.

We missed functions for checking lines of sight (LOS) and for determining visual coverage from a particular position in the map. These functions require a 3D-map. This was not included in the version we tested, but a newer version of FINDERS was demonstrated, which included such functionality – and more. It is therefore safe to assume that such options will be available in any future version of FINDERS.

4.5 Other Comments

FINDERS has several menus with several functions and lots of different messages that can be sent. In fact, it even has some functions we did not expect to find in a BMS, like artillery requests and sending meteorological data. This illustrates that the French and Norwegian Armies have different views on what should be part of a tactical C2IS, and what should be part of a BMS. It appears that FINDERS includes part of what would be the tactical C2IS in Norway. Unfortunately, our test was not suited for testing such functionality, since that requires much more complex scenarios and a high number of participants.

Not surprisingly, blue force tracking was found to be a very helpful aid. Seeing oneself and one's friends on the map is crucial for getting an overview of the situation. This is the core functionality of any BMS. The update frequency is limited by the radio or communication device used, and not by the software. FINDERS also displays heading and turret direction for own vehicle, which is helpful.

Compared to NORTaC BMS, FINDERS has a lot of functionality. Where NORTaC BMS is very simple, fast and designed for a very low level, FINDERS has many more options, but is slower and more designed for a higher level – it includes much of the functionality that today is on the tactical level in the Norwegian Army.

Like all software, FINDERS is subject to continuous modifications and improvements. We have mentioned the 3D-map, which is included in newer versions of FINDERS. Other improvements have probably also been included since our version was installed, and FINDERS will no doubt be updated further in the future as well.

5 Summary

FFI Project 1019, TEKNISK, has tested the FINDERS BMS developed by NEXTER and used by the French Army. We have examined the system and learnt how to use all its functions, and we have tested it in a simulated exercise.

Due to unforeseen events in the Army, the exercise did not become what we had planned it to be, as only two officers were available for the exercise. This unfortunately reduced our possibilities, but we still carried out the exercise, and adding the experiences from our earlier testing of the system, we believe that we now have a fairly good understanding of how FINDERS work, and of its possibilities and limitations. We have, however, not tested FINDERS in a setting where higher levels and more units are involved. When looking at all the functionality in FINDERS, this is probably the setting where one can get the real benefit from a system like FINDERS.

FINDERS is designed for the French Army, and in order to meet their demands, messages in FINDERS is tailored to how the French Army is used to send information. This feels rigid and unnecessarily slow. However, any export version can be tailored to meet the demands of the procuring Army.

The drop-down menus in FINDERS work fine, and are easy to use. However, the forms that have to be filled out feel a bit rigid, and it takes too long time to complete them. More flexible forms would be an advantage. Combined with an update interval of 30 seconds, this illustrates that FINDERS is not designed for the engagement phase.

The shortcuts used in FINDERS were nice to have. We also liked that the shortcut buttons for layers that were turned on were highlighted, so we could always tell with a glance what was turned on and what was turned off.

There are always some minor elements that need improvement. One example of this is the on-off switching of the display, where one in off-state has to hit an invisible header to switch it on again.

FINDERS has most of the functionality we expect from a BMS, and some functionality we did not expect. We did miss having a 3D map, but this is included in newer versions. Also, we believe that the 30 seconds update interval used by the French Army is too long. This limitation is, however, linked to the choice of radio. The French Army uses the PR4G radio, and with another radio, a higher update frequency might be possible. This might make at least the most important function of FINDERS, blue force tracking, useful also during the engagement phase. This may be of importance for potential new costumers.

FINDERS seems like a mature BMS. It is designed for a higher level than the BMS tested in the Norwegian army, and one has to decide what level and what parts of the operation a BMS should support, and what should be handled in a tactical CCIS. If the Norwegian Army should consider FINDERS as an alternative for a future BMS, they should as early as possible get in a dialogue with NEXTER to discuss how the system should be tailored to suit their needs, as they will not have the same requirements and preferences as the French Army.