REWIND

SELECTED ARTICLES FROM FMVAKTUELLT 2003

Hungary chooses Gripen

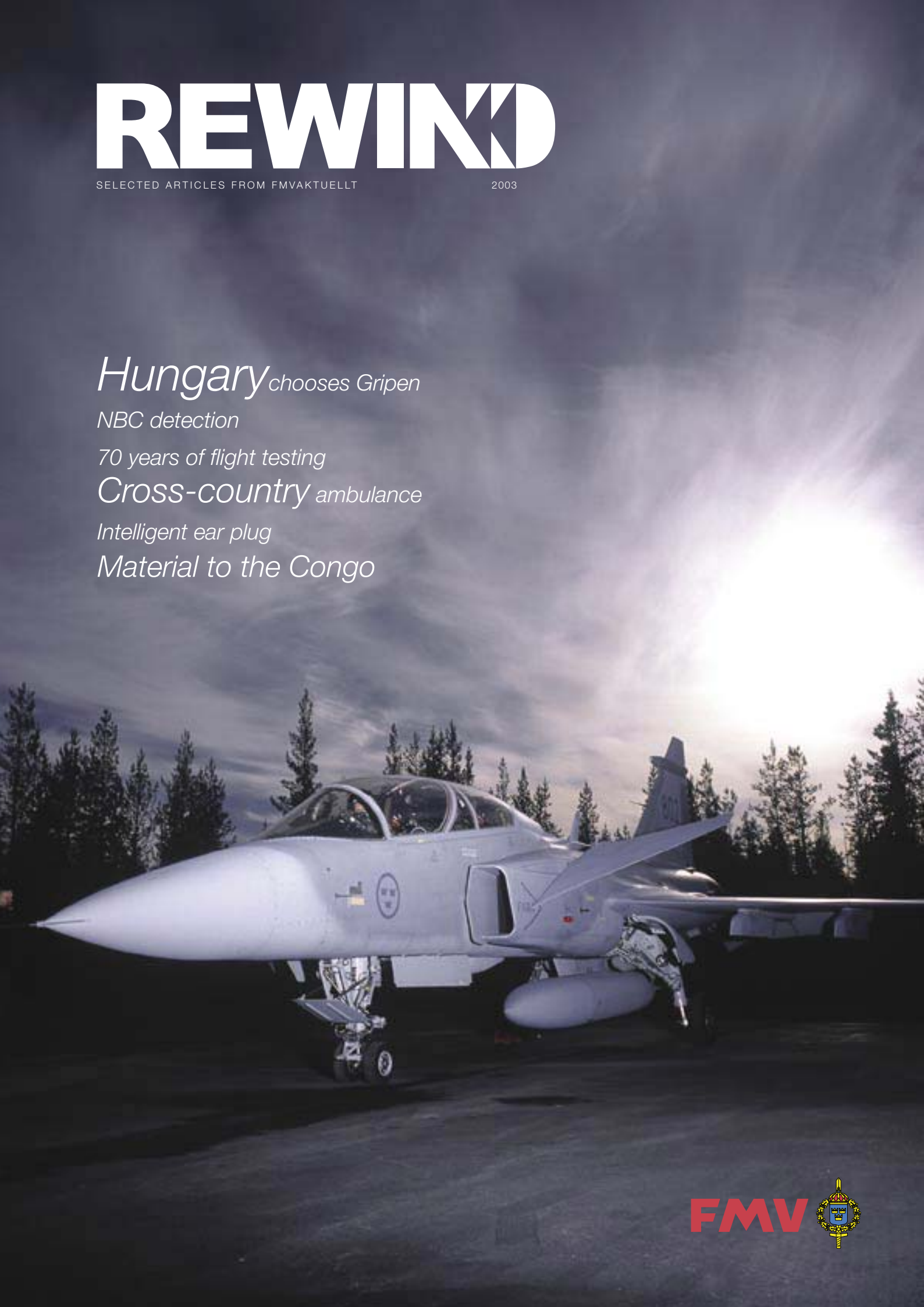
NBC detection

70 years of flight testing

Cross-country ambulance

Intelligent ear plug

Material to the Congo



FMV

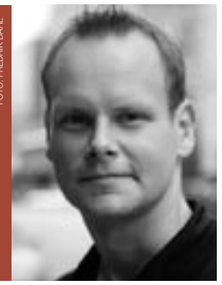


FOTO: FREDRIK DAHL

A taste of FMV:s numerous projects.

2003 was an eventful year for Sweden's most project-intensive authority, FMV (Swedish Defence Materiel Administration). Over 1,400 assignments from the Swedish Armed Forces and other government authorities impose exacting demands on FMV. The authority's external magazine has enabled Swedish readers to share in some of these assignments, large and small, complicated and simple, with the common denominator that they all deal with technology for Sweden's security.

In this English issue we present a selection of articles from 2003, which we hope you will enjoy.

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What is FMV?

FMV has a clear and inspirational assignment: to be responsible for the supply of materiel to the Swedish defence organisation. The challenge FMV face is to find, propose and introduce innovative and cost-effective solutions to safeguard the development of the defence organisation, in relation to both technology and new equipment.

Developments taking place in the total defence system present many great, complex and exciting opportunities.

Military defence has to be developed to operate in a network-based way and in collaboration with international forces, while civilian defence has to cope with severe and unforeseen strains on society. As an independent, civil authority, FMV contributes both know-ledge and a high level of expertise in many different areas.

FMV has around 2.000 employees, mainly located in Stockholm, Linköping, Karlsborg, Vidsel and Arboga. Invoiced sales amounts to around 20 billion Swedish crowns every year.

REWIND

Gripen gets order from Hungary

On 3 February, following export setbacks which were due to anything but the plane itself, FMV was able to celebrate victory by signing a contract for the sale of 14 aircraft to Hungary.

Even selling the best aircraft in the world is no bed of roses if the weather gods and Lady Luck are against you. After the successful sale of 28 Gripen planes to South Africa, the Swedish export project has struggled against a headwind. On several occasions, various defence forces have identified Gripen as the aircraft they want, but something has often cropped up to scuttle the plans. In 2002 the Czech Republic had decided to buy 24 new Gripen aircraft, when the country was hit by floods, which had such a detrimental effect on the economy that they were forced to delay the purchase (In mid-2003 the Czech government approached a number of countries for help with an interim air defence solution. On December 17, negotiations began with the Swedish government (FMV) to lease 14 new Gripen aircraft for a period of up to ten years, starting in 2005.)

The Gripen also looked all set to be sold to Brazil, when the new president decided not to invest the country's money in aircraft. At the last minute, the Polish armed forces opted for the US F-16, even though Gripen represented a better technical and financial deal. Finally, Austria chose Eurofighter, claiming that the plane was as cost-effective as Gripen.

Things don't get harsher than that. But knowing that Gripen was the best aircraft on the market, FMV continued forward and defied the bitter wind. The lean period yielded a dividend on 3 February, when Hungary decided to buy 14 Gripen fighters.

JERRY LINDBERGH

FMV project manger Mats Hansson is delighted about the Hungary deal and hopes it will pave the way for more export openings for JAS 39 Gripen.

Upgraded agreement

The deal with Hungary is the fruit of hard, earnest work. Discussions with the Hungarians had been going on since the early 1990s. They have been close to signing a contract to purchase newly manufactured aircraft on several occasions, but for various reasons the deal has always been put off. Events leading to the current transaction go back to December 2001, when Hungary and FMV signed an agreement for NATO country Hungary to lease 14 Gripen fighters (version A and B) from the Swedish air force for a 10-year period. The agreement also included an option to buy the aircraft after the leasing period had expired.

"That is the agreement we have just renegotiated," says FMV project manager Mats Hansson. "Hungary had a change of government in spring 2002 and the new regime wanted a more long-term solution than leasing alone offers. They were also keen to invest in new aircraft versions, which were upgraded to carry laser-guided bombs and perform air-to-air refuelling".

Under the agreement, Hungary now takes over the ownership of the aircraft after leasing them for a 10-year period. The plane is completely NATO-adapted and corresponds to the C and D version of JAS 39 Gripen, i.e. the version which the Swedes will shortly be using. "This is a better arrangement for both parties than the previous leasing agreement," says Mats. "With these planes, Hungary's air force will be able to hold its own for at least 30 years".

The spider in its web

To put together a deal of this magnitude is a complex task which does not happen in the twinkling of an eye. There have been intensive negotiations between Hungary, the Swedish government, the Swedish Armed Forces and industry. FMV has waited like the spider in its web."Finding a total solution to suit all parties has been challenging," continues Mats. "Issues relating to technology, politics and economy have kept us more than busy".

The planes being delivered to Hungary will be newly produced, but partly built from recycled parts from the JAS 39A, which has not been put into appreciable use. As large parts are recycled, it is no secret that Hungary has got off more cheaply than if they had purchased completely new aircraft.

The biggest difficulty of the project has been finding an acceptable financial arrangement. There are no subsidies from FMV and the Swedish government in the Gripen transaction with Hungary. Costs incurred in the transaction, such as modification and training costs, are borne by the Hungarian government.

There is also an offset agrement, connected to the Gripen contract. This has been concluded between the Hungarian government and Swedish industry.

Continued on next page

PER KJELLSTRÖM

Gripen's flying performance is dimensioned for the interception requirements for speed, acceleration and turning capacity.

BAE SYSTEMS

The Hungarian Gripen aircraft will, just as the later Swedish aircraft, be equipped with a retractable air-to-air refuelling probe for fuelling from other aircraft.

Next phase

After sterling efforts to get everything right and ensure that all parties are satisfied, you might be forgiven for thinking it was time to take a breather, but that is not the case.

"It's more a case of this is where the work begins", admits Mats. "The aircraft must now be upgraded and a large number of support systems, such as simulators, planning systems and tools have to be bought and delivered to Hungary".

FMV will continue to hold the reins between all the parties. The reconstruction itself is done mainly by Saab and the dismantling of the A version, which is to be recycled, comes under the Swedish Armed forces.

When the new aircraft are ready, they will undergo a number of flight trials and in March 2006 the first five aircraft will be delivered to the Hungarian defence force. In December 2007, all 14 aircraft (twelve one-seaters and two two-seaters) will have been delivered.

The new Gripen is an eagerly awaited reinforcement of the Hungarian defence. The country's air defence currently consists of Russian Mig 29s. These are by no means old-fashioned, but it is becoming difficult to get hold of spare parts for them. In addition, the plane has high operating costs. For example, it has a short operating time on the engine, which means that it requires a thorough overhaul quite often.

JERRY LINDBERGH

The Hungarian defence force visited FMV's Vidsel TestRange in August 2002 and were able to see the fighter shoot down a practice target.

Competitors

The order from Hungary is a large feather in the cap for JAS 39 Gripen. There was no lack of competition for the order. All the aircraft on the market, including Eurofighter and the American F-16, were test flown and evaluated by Hungary, but not one of them could surpass the Swedish plane.

"Gripen is the first fourth-generation aircraft in operational service" explains Mats. "This, and Gripen's cost-effectiveness, worked in our favour".

One of the characteristics of a fourth-generation aircraft is that it has fully integrated computer systems, which can create the desired system functions. New system functions can then be created as needed, depending on tactical requirements and technical development.

Eurofighter is also a generation 4 aircraft, but is no match for Gripen in cost-effectiveness. From day one, the Swedish plane was designed and constructed to give low operating costs.
"Our biggest competition actually came from the F-16," says Mats. "But its generation is, if anything, more comparable with our Viggen aircraft".

Hopeful future

For Mats the last intensive year has brought its share of lessons.
"In particular, we learned that in this type of transaction there are very many conditions, aims and objectives to be met. To get everything to tie in requires immense purposefulness and bags of patience. However, we have not come up against the cultural clashes we expected. Granted, there are differences, but the Hungarians are easy to do business with and they are like us Swedes in many ways".

The fact that there are now three countries using the Gripen system (Sweden, South Africa and Hungary) is positive from many aspects. Not only did the Hungarian deal create jobs in Swedish industry and government, it means another country is helping to drive Gripen forward with good ideas and systems development. And with Hungary a full member of NATO, there may be scope for further export.

Jerry Lindbergh

The "Hungarian" aircraft have a cockpit with large colour displays. Analogue reserve instruments, such as horizon meter, altimeter and air-speed meter, have been removed. Instead, reserve sensors present information on the displays if the main sensor fails. Gripen is the first combat aircraft with no analogue reserve instruments.

MONTAGE: SAAB

Historic surface-to-air firing during advance

LENNART BROBERG

Historic testing was carried out at the Ravlunda practice range in June 2003 in the premiere of the first surface-to-air firing during advance with a Swedish anti-aircraft system.

A technical demonstrator of Luftvärnskanonvagn 90 (Lvkv 90) advanced at more than 30 kph and the results were very good. Of a total 54 shots, no fewer than 38 (70%) were within four metres of the target's aiming point. Twelve shots landed between four and eight metres of the aiming point and only four were just outside the twelve-metre boundary. The firing range was just over 2,500 metres and the target's speed was 360 kph.

The shooting was witnessed by the CEO of HB Utveckling AB and the project organisation team for the Stridsfordon 90 and Lvkv 90 at Bofors Defence AB.

Milestone

The surface-to-air firing was an important milestone in the type testing of this technical demonstrator, which FMV delivered to the Anti-Aircraft Regiment in October last year. The Regiment will continue testing in autumn 2003 and spring 2004, when a number of new functions will be ready for type testing. These include improved target correlation, threat evaluation and 3D display from Underrättelseenhet 23. Another technical solution due to be tested is IR-video-Target Tracker, which will improve target recognition and acquisition. The aim is for the demonstrator to join other anti-aircraft systems in the ELITE anti-aircraft exercises in Southern Germany in 2004.

Joakim Dahlbom

JERRY LINDBERGH

The task of paving the way

Few countries manage to provide themselves with a full complement of defence material. Cooperation with other nations is a must in the present area of defence material.

Cooperation is the key to success when it comes to armaments production. In Europe there is agreement about the necessity of collaboration, but it may be more difficult to agree on the actual formulation of the cooperation. For obvious reasons, every nation wants to have as great an influence as possible in each partnership. If the country's own industry is highly involved in the joint projects, it is in a better position if it should find itself in a crisis or war situation.

Pernilla Rempling, head of the FMV International Relations unit, has a central role in Sweden's armaments cooperation with other nations.

"At International Relations, we coordinate FMV's participation in multilateral armaments cooperation, in other words associations and organisations consisting of several, mainly European, countries", explains Pernilla. "Quite simply, we coordinate Sweden's participation in these groups and ensure that the "tools" for Swedish participation are in place, i.e. that there are agreements which Sweden can get behind and that required mandates and government decisions are clarified".

Checking the situation

Pernilla and her staff follow and participate continuously in development in different cooperation areas, such as the Western European Armaments Group (WEAG), NATO-PfP, EU, the six-nations cooperation and OCCAR.

In this way, they can assess which cooperation projects are of interest to Sweden and any possible requirements for Sweden's participation. The cooperation may apply to all or parts of the material procurement process. The tasks may, for example, consist of coordinating the partner nations' material plans or research and technology requirements, as well as pure procurement, validity maintenance and winding up. International Relations has the overall responsibility, but does not, of course, make all the decisions alone.

"We pass on specific issues to the units in FMV and other authorities that possess extensive expertise in the area. We "only" ensure that there are opportunities for cooperation.

Ear-marked resources

International Relations does not run its own materials projects, which means it is an activity that does not give any concrete results in the first stage, but which is necessary in order to enable Sweden to participate and cooperate. As it can be difficult to justify financing for this type of activity, the government has specified in FMV's appropriation directions that SEK 42 million of the Swedish Armed Forces' budget must go directly to FMV for international cooperation and export-

JERRY LINDBERGH

Multilateral cooperation, i.e. cooperation involving more than two nations, is becoming more common in international defence material procurement.

supporting activities. This means that Central Utland is often a coordinating body between different Swedish authorities. As the cooperation relates to the entire materials process, FMV is not the only authority involved. Other government authorities that come under the Ministry of Defence are also involved. In addition to FMV, the Swedish Armed Forces and the Swedish Defence Research Agency (FOI) are most frequently involved.

Bi/multilateral

Cooperation in the multilateral area is a relatively new phenomenon for Sweden. Before 1990, Sweden only participated in bilateral cooperation with certain nations. Today the country have been given several opportunities for international cooperation. Sweden can opt for bilateral cooperation with one country or go for multilateral cooperation. Development in NATO with the Partnership for Peace programme (started in 1994), the six-nations agreement to simplify the restructuring of the defence industry (Letter of Intent 1998 and Framework Agreement in 2000), the decision to create a crisis management capacity in the EU (1999) and the membership of WEAG (2000) and WEAO (2002) are some important multilateral events which have changed Swedens view of armaments cooperation. However, the reason for the cooperation is always the same: to provide the Swedish Armed Forces with the materials it needs to carry out its assignments with minimum expenditure.

"We are involved in a number of cooperation programmes," says Pernilla. "One of the most interesting questions, however, relates to our future involvement. Sweden has had an independent role, but how will development of the armaments area in the EU affect us? What is clear is that the EU will be much more involved in Sweden's future armaments process".

Jerry Lindbergh

JERRY LINDBERGH

Pernilla Rempling has worked with FMV since 1990 and is now in charge of the authority's multilateral cooperation. Pernilla's unit "International Relations" also supports FMV's Director-General in her role as National Armament Director (NAD).

Missile cooperation with the gr eat powers

JERRY LINDBERGH

FMV:s Leif Drougge.

After long discussions, the UK, France, Germany, Italy and Sweden have now agreed on the formulation of the Meteor missile cooperation.

As the representative of the six Meteor nations, with FMV representing Sweden, the UK's Defence Procurement Agency Material December 2002 signed a contract to start development work with Matra British Aerospace Dynamics (MBDA), which is the main supplier of the meteor missile system. MBDA represents an industrial consortium, which includes Europe's leading missile industries, among them Saab Bofors Dynamics.

The Meteor air-to-air missile will offer the very latest in missile technology. It is a Beyond Visual Range Air-to-Air Missile (BVRAAM), which means it operates at a long distances, just like the US Amraam missile, currently used by the Swedish Armed Forces.

"Meteor is the next generation medium-range air-to-air missile," says FMV project manager Leif Drougge. "It is more advanced and effective than the Amraam missile".

When Sweden purchased the Amraan, it was seen to represent a temporary solution, pending a more permanent missile solution. In 1995, when FMV examined the British specifications for the Meteor cooperation, the time was right to move towards something new.

"It's important to be involved in projects like this, mainly to keep topclass defence industry production and knowledge in Sweden," explains Leif.

The requirements for Sweden to be part of the Meteor project were for Swedish industry to be properly involved and for JAS 39 Gripen to be one of the aircraft used as a testing platform. These requirements have been fully met. In addition to Eurofighter, Gripen is the aircraft which is prioritised and Saab Bofors has large part in the project. Ericsson Microwave is also involved.

"We have also managed to book in some of the coming tests at our Swedish missile test range in Vidsel," says Leif. "From a Swedish perspective, we are highly satisfied with the make-up of the contract".

British initiative

The Meteor project started life as a purely British initiative. The other nations were invited in later, when it was realised that development costs were becoming high.

One reason why Sweden was seen as an interesting partner nation is that the country have quite a large defence industry. In other respects, Sweden is a small nation in this context and its defence budget is the lowest of the six nations.

Long discussions

It has taken longer than expected to arrive at the recent signing of the contract. To get six nations to be satisfied with one agreement is a huge job. The needs and requirements of the different countries were many.

It will now take a number of years to develop the Meteor missile. A vast number of sub-systems have to be built, as well as prototypes. A large-scale testing programme also has to be implemented, both simulated and proper full-scale tests. The Meteor system is expected to be completed in 2010. It is not yet known how many missiles the Swedish Armed Forces will purchase.

Jerry Lindbergh

6-nation cooperation

A general framework agreement for armaments cooperation has been in place for 2 years, drawn up in what is known as the 6-nation cooperation. The Meteor project will allow all six nations to participate for the first time in one defence material initiative, based on the framework agreement.

Wiring containers, trucks and rescue vehicles are only some of the materials FMV shipped to the town of Kindu in the Congo. The airfield which has been set up in Kindu is essential for UN work. The Congo's road network is in a poor condition and often looks like a sea of mud.

The shortest possible lead time

The UN is running the MONUC peace-keeping mission in the rebel-populated Congo. On 25 February 2003, FMV was commissioned to produce materials to set up an airfield unit in the country. A race against time then began. The material was to be ready to be shipped from Södertälje on 1 May.

The UN's MONUC peace-keeping initiative has been in progress since 1999. In autumn, it was decided to step up the mission and issue new tasks. The reason for this was to allow all the rebel groups to be disarmed and rehabilitated into a peaceful life. To achieve its high targets, MONUC is now well on the way towards increasing from an international workforce of around 4,000 to almost 9,000.

JERRY LINDBERGH

FMV:s Mats Johansson.

These 9,000 peace workers include 90 recently arrived Swedes. Sweden has acceded to a request to set up an airfield unit in the Congo. The airfield in question is in the central part of the country in a small town called Kindu. The airfield is necessary for flying in aid consignments to the civilian population and transporting UN personnel in the country. The road network in the Congo is in a very poor condition.

Short time

To operate an airfield requires a great deal of equipment and materials. On 25 February, FMV was commissioned by the government and the Swedish Armed Forces to provide all the necessary materials for the airfield. Time was tight. Everything was to be ready to be consigned from Södertälje on 1 May.

"There were in particular three aspects to this job which were that bit more awkward," says FMV's Mats Johansson, who coordinated the job with the Swedish Armed Forces. "To start with, it was extremely urgent, then there was some uncertainty about what materials were actually needed and finally there were many different types of materials systems involved. Everything from power supply systems to wiring and vehicle systems was involved".

Prioritisation

FMV decided to take on the assignment, but to manage the extremely tight schedule, the only alternative was to prioritise the project ahead of other activities. Agreement was reached with the Swedish Armed Forces for FMV to reduce the priority of some of its Armed Forces projects in favour of MONUC.

"FMV had a total of 50 people working part-time on the project," says Mats. "Each was an expert in his or her own area".

Mats emphasises that he and his closest colleagues only structured the working methods and ensured that the important decisions were made. This then formed a basis for those who really did the job, i.e. the FMV personnel who produced and modified the different systems. A technical coordinator from AerotechTelub also played an important role.

Simple quotation

Another solution which was required in order to cut down the length of the project was to simplify quotation work with the Swedish Armed Forces. Project quotations took the form of one overall quotation, instead of each material system being given separate quotations. With this solution, FMV received the order from the Swedish Armed Forces as promptly as one week after the quotation. This meant that work could begin before all the materials were specified in detail.

It takes a lot to equip an airfield. Systems sent to Kindu included everything from power units and sanitary materials to different communication equipment and a number of vehicles, such as cars, rescue vehicles and loaders.

Because of Kindu's hot, humid climate, some equipment had to undergo modifications. For example, several of the vehicles have been fitted with air-conditioning. In addition, UN modifications, such as varnishing, had to be carried out before materials were sent from Södertälje.

Some of the many materials which FMV sent to the Congo were newly purchased, while others already existed in the Swedish Armed Forces and "only" had to undergo various modifications. All materials were delivered on time on 1 May 2003 and the Swedish UN unit has been on site in the Congo since 1 June.

Jerry Lindbergh

Examples of FMV's delivery to the airfield at Kindu in the Congo:

- 7 cars
- 5 rescue vehicles
- 1 fully equipped ambulance
- 1 large breakdown lorry
- 1 key-loader (for container handling)
- 1 large truck, lighting masts for base
- X-ray equipment and other baggage handling equipment, container for control and signal equipment
- Varous items of communication-equipment, such as satellite phones
- GPS receivers
- LAN and modifications to MD110 switch
- Weather observation systems
- Power units
- Uniforms adapted to the climate of the area
- Various catering materials e.g. to fulfil sanitary requirements for example
- Water tanks and containers for dishes
- Sanitary purposes and cooking
- Medical materials.

The Swedish unit working at the airfield is responsible for everything relating to airfield control, meteorological observation, airfield rescue, check-in and check-out, in- and outward clearance, loading and unloading, safety checks, ramp handling, routing, towing and starting assistance for aircraft.

Swedish Coast Guard turns to FMV

The Swedish Coast Guard has a variety of tasks. Operational requirements are constantly increasing and now that new aircraft are needed, they have approached FMV.

The Swedish Coast Guard is a civil authority which comes under the Ministry of Defence. It monitors the Swedish coast and Swedish waters round the clock. Police operations, customs work, fishing control, search & rescue and environment and traffic surveillance are all part of its demanding agenda.

The Swedish Coast Guard needs well-trained employees and specially developed materials in order to fulfil these requirements. They currently have 13 marine surveillance vessels, twelve environmental protection vessels, two combination carriers, three hovercraft, around fifty working boats and three aeroplanes. The CASA 212 aeroplanes are now due to be replaced after many years of faithful service.

JERRY LINDBERGH

"It is important for us to put ourselves in the Swedish Coast Guard's shoes," says FMV project manager Ralf Wrangö.

1,000 flying hours

The new aeroplanes have to fulfil demanding requirements. The air squadron makes flights just about every day and each plane flies about 1,000 hours a year. In the future, the flying time will increase more. This means that it is important that the aeroplane's systems are reliable and function as good workplaces.

"For the sake of the pilots and operators, the new aircraft must be quieter," says FMV project manager Ralf Wrangö. "I have travelled in the CASA plane a few times and the noisy working environment is an obvious strain".

Environmental focus

It is as yet unclear what the new aeroplane will look like and what will be prioritised along with the internal and external environmental aspects. It is highly likely that it will be bigger and faster, but it has not yet been decided whether it will be a propeller or jet aircraft.

"There are advantages and disadvantages to everything," admits Ralf. "Jet aircraft are faster, but have poorer efficiency at low speeds, which is not good environmentally".

At the end of 2003, FMV will be sending a request for quotation to suppliers. The tender period is four months, which means that in spring 2004 FMV can evaluate the tenders received. Only then can they decide which aircraft is best suited to the Swedish Coast Guard's present operations.

"There will probably be between five and ten suppliers submitting tenders," estimates Ralf.

EU procurement

Procurement follows rules defined by the EU and means that all companies with the right profile may submit tenders. When FMV has evaluated the tenders and appointed a specific supplier, there will be a rest period of ten days. The suppliers then have a chance to object to FMV's decision. FMV must be able to show how the evaluation took place and why the supplier in question was chosen. The order can then be placed and production gets underway.

SWEDISH COAST GUARD

With SLAR radar (Side Looking Airborne Radar) the Swedish Coast Guard can search for oil spills over large areas. The radar covers an area of over 15,000 square kilometres. An oil slick can be seen in the picture.

The FLIR sensor (Forward Looking Infra-red Sensor) is an extraordinary complement to SLAR. FLIR allows round-the-clock surveillance. The night picture shows a vessel which is leaking oil.

"The delivery date for the new aircraft has not been fixed yet," says Ralf. "We want to have them as quickly as possible, but if you force an unrealistic delivery time onto the supplier, there is always a danger of receiving an inferior product. The Swedish Coast Guard will probably receive the first aircraft during 2006 and the last one in 2007".

World leader

Procurement is a complicated business. These aircraft are unique. The coastal surveillance of many countries is, unlike that of Sweden, completely military or covers only customs work. The role of the Swedish Coast Guard is much broader and requires equipment at the leading edge of technology.

"In size alone, there are many interesting aeroplanes, but these must be greatly modified in order to suit the Swedish Coast Guard's purposes," says Ralf. "It isn't enough that they are 20–40 seater twin-engine planes which have been strengthened to take more load and fight corrosion".

Reference group

FMV is working in close collaboration with its customer. A reference group made up of Coast Guard personnel is consulted in each individual matter. Ralf also has the help of a specialist team in the areas of "basic aircraft", "sensors" and "avionics and communication". These teams consist of experts from FMV and experienced pilots and operators from the Swedish Coast Guard.

"It's important for us to cooperate closely with the Swedish Coast Guard, as they are experts in their field," says Ralf. "They are also the ones who have to live with the system for the next 20 years".

In total, 30 people are involved in the project, 20 of them from FMV and 10 from the Swedish Coast Guard. Most contribute on a part-time basis, as they are specialists in their own areas.

Peak technology

Like the old aeroplanes, the new aircraft will be equipped with lots of exciting technology. One new addition in the area of technology is a satellite communication system which can localise oil slicks in the water.

Existing systems have also been refined. These include SLAR (Side Looking Airborne Radio), which covers distances as vast as 15,000 sq. km. This system is supplemented by an IR scanner and a UV scanner. The IR scanner measures radiation temperature, enabling it to indicate where an oil slick is thickest. Those concerned then known where to begin the cleaning-up work. The UV scanner

Continued on next page


KUSTBEVAKNINGEN

measures the reflective properties of the water surface, which allows even the very thinnest oil layers to be localised. These systems function extremely well in good visibility. The FLIR system (Forward Looking Infra-red Sensor) supplements them in the dark. In addition to these special systems, there is also various camera, radio and navigational equipment.

"As well as the specific surveillance equipment, there is also a great deal to think about," says Ralf. "For the aircraft to be a good workplace, everything from avionics to communications systems and space must be well thought out. It is also important that operations can grow with any future extra equipment".

Finding the ultimate aircraft/equipment solution is a delicate task. To keep within the specified budget, there must be some compromising of requirements. But how do you compare the aircraft's speed resources with sensor performance? And how do you prioritise low fuel consumption over low noise levels? Life is full of prioritising and making choices, but some have more effect on society than whether you choose sausage or meat balls for supper.

Jerry Lindbergh

Attractive programme for management training


JERRY LINDBERGH

From left: Kjell Nilsson, FMV, Lars Stigendal, SKK, Torsten Burman and Alf Levin, RSV, and Michael Jarl, FMV.

On 2 June at FMV in Stockholm, representatives from the Swedish National Tax Board (RSV), the National Council for Quality and Development (SKK) and FMV met to discuss the future and development in the area of management. The starting point was FMV's management training programme, which attracted great interest from the other authorities.

"Here at RSV, we have a very positive opinion of FMV's training," says RSV's Management Training Officer Alf Levin. "We study many different management training programmes and are impressed by FMV's thought process and ability to provide concrete training".

Modern & far-sighted

They are also interested in FMV's methods at the National Council for Quality and Development (SKK), which is a government authority actively engaged in the development of other authorities. Lars Stigendal, Senior Advisor at SKK, with part-time duties for RSV, also took part in the meeting.

"I have had previous contact with FMV in the area of quality and my opinion is that FMV is producing modern and far-sighted management and executive training," he says. "In particular, the combination of different management training for different levels, FMV's employees' council and its "high potentials" development assessment programme is attractive".

At the forefront

Kjell Nilsson is FMV's management training officer and he thinks that FMV lies at the forefront as a knowledge company. "A success factor for us is the integrated thinking in our management training and the development of leadership qualities in resources dimensioning and the production line in our operations," he points out.

FMV's senior management training programme (HLP) focuses on supporting personal development in managers, which is greatly appreciated among those participating.

FMV will be concentrating next on developing a stronger link between the different management programmes and the authority's actual supply of management. One example is the authority's project management training, where approved certification as a project manager (PMP) not only results in formal competence recognition but also a skills-related salary level.

Michael Jarl


ANDERS WIKLUND

Well-equipped ambulance for rugged terrain

If an aircraft crashes in virgin territory, ambulances that can get across country are needed. Based on the Bandvagn 206, FMV has developed a rescue caterpillar vehicle with exceptional cross-country mobility and a medical equipment level superior to that of a civilian ambulance.

For the Swedish Armed Forces' air base rescue service, it is important to have access to vehicles which manage all types of air rescue activity. The service's three cross-country rescue vehicles are elderly and are now being replaced by 21 modern rescue caterpillars or, you could say, ambulance caterpillars.

"The new rescue caterpillars are based on Bandvagn 206 and can accommodate much more medical equipment than the old ones," says FMV project manager Johan Åqvist.

Even compared with a civilian ambulance, the new rescue caterpillars are abundantly equipped. As much of the care will be administered in the field, the vehicle needs more apparatus and equipment.

Constant heat

Despite its ample equipment level, the rescue caterpillar 2077A has room for two seriously injured (lying) casualties or one seriously injured and three lightly injured casualties (sitting). There is one simple and one advanced stretcher position available. The advanced position is compatible with 16 different types of stretcher.

To allow proper care of casualties, the vehicle is also equipped with cooling and heating systems, which permit a temperature of 20 degrees to be maintained in the vehicle, regardless of whether it is +40 or -40 degrees

Continued on next page

ANDERS WIKLAND

Project manager Johan Åqvist (on the ground) is handed parts of a stretcher by Thomas Olsson, AerotechTelub.

Cooling and heating systems ensure a constant temperature of 20 degrees in the vehicle, whether it is +40 or -40 outside.

outside. Only minor modifications have been made to the outside of the caterpillars. However, they have been varnished in a light easy-care NATO green, which does not absorb water as is the case with the Swedish Armed Forces' normal camouflage colours. 2077A has a plastic body and can be affected by mildew if the colour absorbs water.

"All in all, the vehicle has a very wide area of application, both internationally and in civil society," points out Johan. "Its mobility means it may be serviceable in peacetime, for example when nature strikes. When communities are snowed in, the vehicles can serve as ordinary ambulances, for example".

Its only real disadvantage as an ambulance is its speed on normal roads. It has a top speed of 55 kilometres per hour, which is, of course, on the slow side for urgent transportation to the hospital. That is why it is the main intention that 2077A will meet up with a civilian ambulance after driving casualties out of the rough terrain.

Successful project

The project, which started with a meeting just over three years ago, has gone extremely smoothly. The medical equipment was delivered by the Medical Service Centre of the Swedish Armed Forces and installed by the German company Binz, which is situated just outside Stuttgart.

"The partnership with the suppliers has worked very well, as we have kept close contact with them right from day one," says Johan. "In the case of Binz, we sometimes checked the work several times a day, so that any minor faults or misunderstandings could be put right straight away".

FMV's suppliers must meet stringent requirements, both in terms of quality and working methods. To start with, Binz found FMV's requirements extremely tough, but after a while they began to appreciate the Swedish authority's requirements level, as the frequent directives and the constant line saved both time and labour for all parties involved.

Mark of origin

One element of the work which has required much effort is FMV's requirement for access to the mark of origin of all parts in the rescue caterpillar's different systems. If a company has, say, delivered an air-conditioning system, FMV has asked for the product to be broken down to the smallest components and the mark of origin, even for each tiny screw, to be documented.

"There are several million bits and pieces in the Swedish Armed Forces' materials registration system," says Johan. "This means that we may already have agreements for some of the components. When we need spare parts for the rescue caterpillars in the future, we can then go straight to the manufacturer of the component we need, rather than approaching a new supplier".

Oh, and it even floats. 2077A is completely water-tight and can be driven in the water. The rescue trailer contains items such as 2x70 kilos of fire-extinguishing powder and spades.

ANDERS WIKLAND

As the rescue caterpillar "Räddningsbandvagn 2077A" is mainly used out in the field, it has a medical equipment level superior to that of a civilian ambulance.

Early documentation

All the documentation has been produced and is available on CD, together with diagrams for use, lubrication and repair. Users have all the necessary information about the rescue caterpillars before the vehicles themselves have been delivered. In summer and autumn 2003, FMV will be arranging training for rescue caterpillar handlers.

The project is now (spring 2003) in the final phase of series production of the 21 caterpillars ordered by the Swedish Armed Forces. "It's a great feeling," says Johan. We have subjected the prototype to several months of hard testing and know that we shall be delivering excellent rescue caterpillars. The delivery will be in two stages during summer 2003.

In peacetime, the caterpillars will be placed in wings and helicopter battalions and in the event of war will be located at various airbases. One or more vehicles are being allocated to F4, F7, F17 and F21 wings and the battalions in Säve, Boden, Berga and Malmen.

Jerry Lindbergh

The rescue caterpillar is no racer. The idea is for it to meet up with civilian ambulances when it reaches ordinary roads

Räddningsbandvagn 2077A

Length: 6,900 mm
Width: 1,920 mm
Height: 3,150 mm
Height with light mast: 5,000 mm
Weight: 5,380 kg

Vehicle equipment:
Xenon lighting, electric light mast with 3x55 watt lighting, wireless communication in front and back truck, GPS receiver, three different communication systems (air, ground and civilian rescue units), AC system in front and back truck, additional heater in front and back truck, seats all with three-point belts, automatic trickle charging/heating via 400-volt connection.

Medical equipment
Emergency bag, oxygen treatment equipment, breathing masks, defibrillators, warm water, ventilator, catheter equipment, laryngoscope, drip equipment, fire blanket, neck collars, pulsoximeter, blood pressure meter, tube stethoscope, pressure infusion cuff, stretchers, rescue vest, vacuum mattress and various items of equipment such as pumps, dressings, compresses, forceps, scissors, sprays etc. In total the vehicle contains 250 medical items.

To find out more, please contact Johan Åqvist: +46 8 782 46 74

SCANPIX

Network-based defence

– like a well-synchronised football team!

Network-based defence, NBD, is on many people's lips these days. But what actually is it? And how can it be compared to a football team?

In simple terms, NBD is all about creating a defence in which its units can coordinate with each other by having access to the same information and working on the basis of integrated situation information. The strength then lies in being able to make decisions and act more quickly than the enemy, while making optimal use of resources. Sweden's traditional division into army, navy and air force has meant that each of the services has had its own weapons platforms, radar sensors and hierarchical command chains. This normally means that the operational capacity of each of the services represents a number of isolated areas relating to its own weapons platforms, as the range is limited for each sensor and each weapon.

In network-based defence, defence is not divided into services, but into operating systems, sensors and command systems. All sensors are linked together via a common network and it must be possible to coordinate the information from the sensors into integrated situation information, which can be disseminated to all decision-makers. Who the decision-makers are depends on the situation. The system for information control defines the formulation of the organisation. This can mean that a platform commander does not always make decisions on his/her sensors and weapons. He/she may instead play a subordinate role by being ordered to participate with his/her weapons based on information from other quarters.

Range

When ground, sea and air combat units are linked to a common network, geographical aspects are less important. The operational range is no longer limited by the range of individual platforms, but can now be extended over large continuous areas. With network-based defence it is possible, for example, to send information from a JAS 39 Gripen, to a submarine and vice-versa. In some situations, weapons precision can be increased if a weapon is used from one unit and target information from another.

Another advantage of NBD is that it enables well-trained, special-task units which follow basic combat rules to organise themselves according to the situation. This is called self-synchronisation and allows situation-controlled action without formal and time-consuming hierarchy. A simple comparison can be made to a football team, where the players constantly synchronise their actions with each other depending on the snapshot situation, while the game follows basic rules and regulations. One of the major advantages of self-organisation is the increased tempo. As in a football match, one lost second can be decisive.

Rules

FMV is responsible for drawing up guidelines for the technology behind network-based defence.

"We worked to produce rules for NBD a few years ago in the LedsystT project," says Lars Ahlm, LedsystT project manager. "The rules are important in linking the authority and materials to the future system".

From a purely theoretical perspective, creating a common network does not sound too difficult, but reality is quite different. It is a case of creating a network which can process and sort information from a large number of different information sources. These can be everything from the sensors' raw data, photos, videos and map data of human observations. Everything has to be refined, filtered, consolidated, compared and compiled into one integrated picture. How do we produce the frequency space to send so much information and how do we create sufficient security in the system? Nothing must go wrong!

"Today's technology is not adequate for network-based defence, but in a few years things will look different," claims Örjan Eriksson who coordinates everything to ensure that FMV's present material and new systems are as NBD-compatible as possible.

JERRY LINDBERGH

Örjan Eriksson and Lars Ahlm (in the foreground)live NBD during working time. The story doesn't tell which football team they support.

Design partners

NBD work is constantly moving forward. After initially drawing up the rules, the LedsystT project has today built up a development environment which permits experiments and tests to be started. The capacity of the defence telecommunications network (FTN) has also been expanded and increased. In the far future, it is envisaged that it will be possible to use this network for testing throughout Sweden.

"Another big step forward is bringing in design partners," says Lars. "These companies help us to produce design rules relating to what the network looks like and how it is to be constructed. Saab and Ericsson are our main partners in the form of a jointly-owned company. US companies IBM and Boeing are also subcontractors".

LedsystT is a development project with a high level of innovation. It is not designed to generate ready systems, but demonstrations every half year from now on. The most recent demonstration was called Demo 03 Höst and was carried out in mid-November, in conjunction with the inauguration of the Swedish Forces' command system centre in Enköping. The next demonstration to look forward to is Demo 04 in May 2004.

Jerry Lindbergh

ERICSSON MICROWAVE SYSTEMS

The watching eye

Air attacks can come quickly, from several directions at the same time. Sweden's latest addition to its defence against air attacks is called the Underrättelseenhet 23.

To guarantee that Sweden maintains a high level of security against enemy aircraft the country must constantly monitor its own airspace and that of our neighbouring countries. This surveillance takes place by means of complex interplay between the different radar systems of the Swedish Armed Forces.

JERRY LINDBERGH

Max Berthold, FMV's former task manager for UndE23.

It is essential that the exchange of information between the different radar units and the command and control centres is rapid, as there is precious little time to act when combat aircraft or cruise missiles are approaching.

Scenario

In a scenario where aircraft are threatening Sweden, the Air Force tackles the enemy first. If the enemy is flying over water, naval forces also come in.

"Both aircraft and naval vessels are used for surveillance outside Swedish airspace," says FMV's Max Berthold. "Gripen and the FSR890 airborne radar aircraft are examples of aircraft with different types of surveillance equipment, while the corvette Visby represents a vessel that will be particularly suitable".

For Swedish coastal and land surveillance, monitoring is supplemented by the navy and air force's fixed radar stations. Information on the air picture is collected from these different stations throughout Sweden and processed in the air defence's command and control centres (STRIC), located in secret rock cavities around Sweden.

If the enemy encroaches into Swedish airspace, the ground-based air defence (Anti-Aircraft Artillery) also comes in with mobile radar and fire units. They receive information from the command and control centres about the air position of each aircraft, to avoid firing at the wrong plane. Information exchange between all the current mobile radar stations is manual, by radio. "This is old-fashioned," admits FMV's Max Berthold.

"In a modern invasion, the targets may be so numerous and rapid that it probably would be impossible for the brain to handle all the information".

Underrättelseenhet 23 (UndE23) will dispense with this information processing. UndE23 collects information from the other types of mobile radar stations and consolidates the air pictures from the different stations into one local and integrated overall picture for the Anti-Aircraft Artillery.

Background

Back in the early 1980s it was clear that Sweden needed to supplement the ground-based, mobile part of its air defence with something to meet the new threat, i.e. a large number of small, fast targets at both high and low approach altitudes. It was realised that the anti-aircraft artillery's different units needed to work from one very accurate and integrated air picture, which had not previously been the case. It would then be possible to optimise the effect of the ground-based fire units which were available.

UndE23

After countless requirements studies in the Swedish Defence Research Agency (FOI), the Anti-Aircraft Artillery and FMV, the UndE23 system is now almost ready. In fractions of seconds, the system permits an integrated overall picture of the current local air picture to be automatically consolidated and subordinated fire unit operations to be planned.

This overall picture can be consolidated, as the system has its own search radar (100-kilometre range) and can receive information from mobile ground-based radar stations and STRIC. The Swedish Armed Forces and FMV are involved in extensive discussions and consequence analyses about letting UndE23 distribute the compiled air picture back to STRIC. This would make the STRIC system superior to its precursors, as personnel would receive a much more accurate air picture. This would mean that, with information from a number of UndE23s, the STRIC picture would not only contain information from the navy and air force, but also from 30 – 40 of the air force's ground-based mobile radar stations in the range of 25 and 40 kilometres. STRIC's more exact air picture, which is now being discussed, would mean a defence with faster, more efficient use of the Air Force's surveillance and combat resources.

The UndE23 prototype, which has already been delivered to FMV, is based on a Scania truck, but MAN trucks will be used when the actual delivery starts, as they have much better cross-country properties.

ERICSSON MICROWAVE SYSTEMS

UndE23 has the Anti-Aircraft Artillery's first 3D search radar, which means that the system can detect the distance, direction and altitude of a target.

3rd generation

Underättelseenhet 23 is the 3rd generation of search radar (Giraffe family), which Ericsson Microwave Systems AB supplies to the Swedish Armed Forces. The previous models are PS70 and PS90. UndE23 consists of three main components: the sensor (i.e. the radar), the sensor fusion part (which creates an air picture from received information) and various items of communication equipment.

The sensor is of the 3-D type. This means that it can detect the distance, direction and altitude of a target. Until now, altitude information has been something which the firing units have had to find out themselves. The sensor has a variable range of up to 100 km, approx. 65 km further than the PS70 and PS90 sensors. At a shorter range, the UndE23 system is so sensitive that it can distinguish between an aeroplane and a helicopter. This information is very useful when the system has to determine which threat should be warded off first. If the anti-aircraft artillery has to protect a landing strip, aeroplanes must be prioritised, as they can drop bombs. If its main task is to protect a mechanised fighting unit, the helicopter will probably be prioritised, as the present anti-tank helicopters represent a major threat to tanks and combat vehicles.

The UndE23 sensor can also be used to detect targets on the water, but

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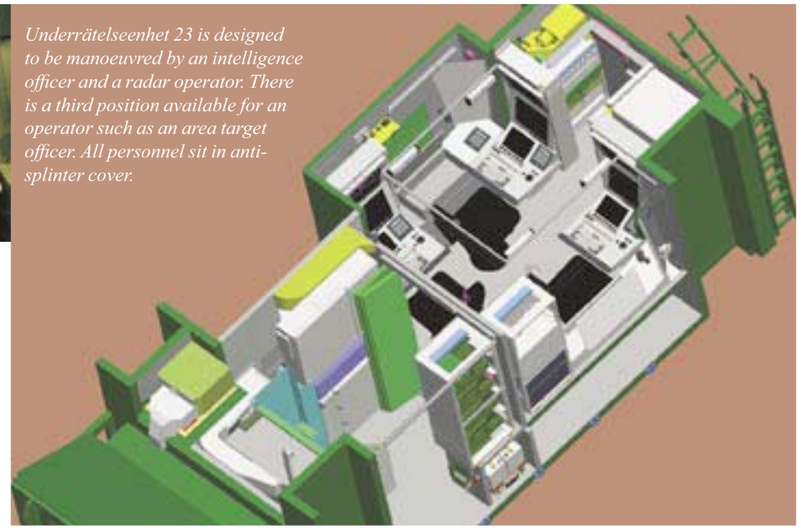


Underrätelseenhet 23 is designed to be manoeuvred by an intelligence officer and a radar operator. There is a third position available for an operator such as an area target officer. All personnel sit in anti-splinter cover.

at distances below 100 km. Map data can then be used to disregard fixed objects, such as islands and lighthouses.

UndE23's other main component, the sensor fusion part, is the component which generates one integrated air picture from its own information and the information it has received. This gives good accuracy about the target. With this collated information, it is also possible to identify friendly, enemy and unknown targets. This is important, as it forms the basis of UndE23's automatic threat evaluators and operations planners. The threat evaluators and operations planners come under "tactical functions" and are used to optimise an anti-aircraft unit's action against identified targets. Computers continuously calculate how great a threat detected aircraft represent to different objects on the ground. These threat values are then used to form a list, which ranks the enemy aircraft by the intended order of engagement. From this list, the fire units under the UndE23 in question receive information about which units will engage which targets.

Communication (the third main component) between UndE23 and units such as interacting radar stations, its own subordinated fire units, naval control centres and STRIC is over a tactical telecommunications network called the TS9000. Secure communication is an important feature of UndE23, which is why much work has been injected into producing jamming-resistant solutions.

Operational reliability

Operational reliability and good jamming resistance has been prioritised during the development of UndE23. Jamming protection has been improved by frequency-hopping and the facility to continuously select the least jammed frequency, thereby obtaining the longest range and good capacity for hitting small targets. Advanced waveforms, high-tech signal processing and powerful computers allow a low signature level to be obtained (in terms of radar signals), making the unit more difficult for the enemy's radar signal search equipment to detect.

The sensor can also carry out sector transmission, which means that it searches in certain predefined points of the compass, but is turned off between them. In this way, energy radiation is avoided in certain directions, which also makes detection difficult. In addition, passive surveillance is also possible. The sensor is then used to "listen" for other radar signals (in this case, airborne enemy vehicles with the intention of jamming ground-based radar stations).

The UndE23 project has also included a componentisation project, which means that all the software is developed in sub-components. Pieces of software can be replaced/serviced/upgraded without affecting the rest of UndE23's software. This means that the UndE23 can still be used even if some components are missing. This new way of building software components has led to feasibility studies for a function called FUMLvUndC (Funktionsmodell Luftvärnsunderrättelsecentral), which is the equivalent of a UndE23 without the sensor component. It has also been possible to re-use some components from UndE23 in the Corvette Visby project and the Arte740 search radar.

Future defence

Sweden has re-assessed the need for a large invasion defence to build a modern, flexible operations defence, capable of working on a national and international basis. UndE23 fits into this concept well. The project enters a hectic phase in spring 2003, with a large number of tests and a planning phase ahead of Demo 05/06, which is the Swedish Armed Forces' demonstration of the network-based defence (LedsystT). UndE23 and FUMLvUndC will be included in the demonstration, due to their capacity to consolidate air situation information, distribute an integrated air picture and pass on intelligence to subordinated fire units. So far, Ericsson has delivered one UndE23 prototype to FMV. Series delivery begins in 2003.

Jerry Lindbergh

CHRIS PRICE

UndE23 can receive information from other radar systems (such as PS70, PS90 and Arte740) and has the task of consolidating the current air picture and then giving orders to subordinated fire units. UndE23 has a long range, but, like other radar systems, is unable to penetrate permanent features, such as rocks. To achieve good coverage of a difficult-to-access area, other mobile radar stations are therefore put out when UndE23 encounters a radar shadow. UndE23's ability to utilise information from the other stations and consolidate it into one air picture means that complete coverage of a large, difficult-to-access area can be achieved.

From the consolidated air picture, UndE23 calculates which of the available fire units is best suited to deal with each detected enemy target. Fire units such as the Bamse and Hawk systems can also communicate back to UndE23 and report whether they have run out of missiles or whether they are about to re-load. UndE23 then calculates which other fire unit is most suitable to take over the target.

Facts about UndE23

Sensor
Search capacity: Air and surface targets
Antenna: Measures in 3D (electric phased array)
Range: 30, 60 or 100 km
Height coverage: >20 km for distances up to 60 km. >6 km for 100 km distance.
Output: 20 kW (peak power)
Frequency: 5.4 – l5.9 GHz
Jamming resistance: Sector transmission, least jammed frequency, high dynamics in receiver, intermittent transmission etc.

Intelligence management
Sensor fusion: An integrated air picture is created by means of interaction with other sensors in the Air Force, Navy and Anti-Aircraft Artillery. UndE23 consolidates all relevant target information, such as identity, type, position (both 2D and 3D), jam bearing and jam direction, making an integrated air picture in real time.
Tactical support system: Automatic threat evaluators and operations planners (can be adapted according to assignment).

Communication
Common communication computers for the anti-aircraft artillery, which also are included in units that receive the UndE23's integrated air picture, for example naval control centres and the interacting ArtE740. UndE23 communicates by radio and the army's tactical telecommunications system (TS9000,) which allows tactical control on both duplex connections (RBS 23 BAMSE and RBS 97) and unidirectional connections (RBS 70 and RBS 90). Sensor information is currently received and distributed on 10 unidirectional and duplex channels.

Cab
ISO 20 foot standard container med vehicle MAN SX 8x8
Weight: 25.7 tons
Length: 10.3 m
Width: 2.5 m
Height with raised mast: 9.3 or 13.2 m
Height with lowered mast: 4 m
Good cross-country mobility (equivalent to Ground truck 30/40)

For further information, please contact task manager Anders Fredlund,
FMV, +46 8 782 53 18

SYLVIA DAHLBERG, SKYDDC

NBC – an abbreviation under fire

The abbreviation NBC sends a shiver down the spine of most people. Nuclear, biological and chemical weapons are tending to become a bigger threat to society with every year that passes.

As the likelihood of large-scale use of weapons of mass destruction is reducing in the world, the fear of NBC (Nuclear Biological Chemical) weapons is increasing. As far as Sweden is concerned, it is mainly terrorism and possible environmental accidents which may constitute an NBC threat.

NBC company

In order to face up to the new threat scenario, the government ordered the Swedish Armed Forces to form an NBC company. The Swedish Armed Forces then came to the conclusion that this company should include two NBC detection vehicles, which would be able to detect NBC emissions in a quick, simple and safe way. In March 2003, FMV received an order from the Swedish Armed Forces for two of these demonstrator vehicles. After close collaboration with the supplier Bofors Defence, the Swedish Armed Forces and the Swedish Defence Research Agency (FOI), the vehicles are now ready. On 13 October 2003, they were delivered to the National NBC-defence centre in Umeå. They are to be evaluated over two years by the detection platoon in the newly formed 140-strong NBC company. The actual detection platoon consists of one career officer and 25 conscripts, two of whom are women.

"In a bill, the government has decreed that Sweden must obtain strategic competence in protection against NBC weapons," says FMV's planning manager Åke Sjökvist. The formation of the NBC company and the acquisition of the NBC detection vehicles are important building blocks for developing such competence".

However, if Sweden as a country is to achieve the required strategic NBC competence, it is not enough for the Swedish Armed Forces and the country's total defence authorities to put their shoulders to the wheel. Swedish industry must also develop competence in the area.

Armoured ground vehicles

The NBC detection vehicles are based on the Pansarterrängbil 203 A armoured ground vehicle and have been fitted with NBC equipment. The function of the vehicles is to safeguard roads for advancing and to cordon off areas which have been contaminated, i.e. polluted or infected. When they discover emissions, these must be reported to the company commander and if applicable to any adjoining units, so that they can take action before they or others are exposed to danger.

SYLVIA DAHLBERG, SKYDDC

Detection is completely automatic and only needs to be monitored by the vehicle's operators until an alarm is issued by a sensor. It is then up to the operators and recipients of the alarm message to decide what action needs to be taken.

JERRY LINDBERGH

Planning manager Åke Sjökvist (left) and task manger Lars Welander are in charge of FMV's production of NBC vehicles.

This work is not only exacting on the vehicles' sensors and communication technology, it is also very important that the vehicle is absolutely tight, so that dangerous substances cannot enter it.

"Yes indeed, that's why we have fitted the vehicle with internal as well as external detection," says FMV's task manager Lars Welander. "If any form of dangerous substance enters the vehicle, it is important that the crew know about this quickly".

However, in this first evaluation phase, it will not be possible to detect all dangerous substances. So far, it has been decided to restrict the detection capacity to nuclear radiation and a number of chemical weapons, such as mustard gas and VX gas. However, being able to detect biological weapons appropriately with a vehicle is a challenge which will take more time to resolve. In the current situation, there are no systems which deliver the required performance.

Alarm message

The vehicle's sensors are read by newly produced software (NC-Dart), which FMV has ordered from the Swedish Defence Research Agency's sensor technology department. On discovery of contaminated areas, the software compiles alarm messages which contain information on the type of substance, the size of concentration, where the substance occurred and so on. These messages are then sent by radio to a message centre or a subordinated unit. It must also be possible to use the messages for further analysis in an NBC decision support system which FMV has produced for the NBC company. This system will also act as a type of knowledge base on NBC matters and incidents.

Detection on the move

One of the absolute advantages of the vehicle is that it can carry out its detection work at a speed of 70 kilometres per hour. There is no sampling by means of projecting arms or similar, which is the case with the corresponding vehicles of some other countries. Instead, detection is completely automatic and only needs to be monitored by the vehicle's operators until an alarm is issued by a sensor. It is then up to the operators and recipients of the alarm message to decide what action needs to be taken.

The vehicle can detect nuclear radiation and different chemical emissions, whether they are in the air or have fallen to the ground. In the latter case, the pollution simply sprays up onto a sensor positioned behind one of the wheels.

SYLVIA DAHLBERG, SKYDDC

The NBC detection vehicle can perform its detection work at a speed of 70 km/h.

Duo

There was never any doubt that the NBC company needed more than one vehicle. With two vehicles, methods, operations and procedures can be created, developed and tested in the new company. For example, being able to search several areas at the same time is necessary in order for training and testing activities to be realistic.

The National NBC-defence centre has had the vehicles for two months now and they are already being used to train the NBC company's detection platoon. Live weapons are being used in the training, which brings system security work into focus. Present experiences will form the basis of the development of the next version of detection vehicles, which are due to be delivered to the Swedish Armed Forces in September 2005. This vehicle is intended to have more of a series character and will offer more N and C instruments, as well as some form of sensors for biological substances. Other additional functions and systems are expected to include sampling equipment, weather measuring equipment, armaments and equipment for marking out contaminated areas.

Jerry Lindbergh

SYLVIA DAHLBERG, SKYDDC

Ground emissions are detected when they spray up onto the sensor behind the wheel.

JERRY LINDBERGH

Mattias Skeppstedt with the wire which is normally used to trigger mines like the one in the picture. When the NMS project is completed, the wire's days will be numbered.

Remote control of minefields

It's impossible to be everywhere at the same time. So Sweden's defence needs sensor systems with built-in combat functions, which autonomously monitor unmanned parts of the country.

People often say that Sweden is a small country, but if you consider its area, this is not strictly true. With a surface area of 449,964 sq km, only Russia, France and Spain are bigger in Europe. The large area and modest population make Sweden a country which is all the more in need of various types of surveillance system. For this reason, FMV has launched a new project in the area of land mine systems. The project is called NMS (Network-based Mine and Sensor Systems) and is based on the surveillance and remote control of mine fields against combat vehicles. The capacity to govern and control mined areas means that NMS fulfils all the international conventions relating to the use of mines.

Sensors

Each mine in the new system will be fitted with a number of sensors, known as mine detonators. These detect approaching vehicles, using IR technology, determine their position using GPS, for example, and classify them according to type. The classification is carried out by the sensors' own databases, which use specific algorithms to recognise different vehicle types by factors such as ground vibrations and sound emitted from the vehicle. The mine detonator is also the part that triggers the mine when an enemy vehicle is in the mine's area of operation. To further increase the information level from the minefield, the mines will also be interspersed with extra sensitive ground sensors, which are not connected to any mine.

"We already have both the mines and ground sensors," says FMV project manager Mattias Skeppstedt. "What we're missing is a communications network, which can take care of their information. So that is what we are creating now".

Information

The information collected from the mines and sensors in a minefield will be sent to the tactical officer responsible for the area in question. The information is presented as digital maps or tables on the officer's hand- or vehicle-mounted presentation unit. With this tool, the officer can then carry out remote programming of the performance of one or more mines or sensors. If required, he or she could, for example, order the mines only to trigger against a specific combat vehicle type or not to explode at all.

"Because NMS fields can be remotely set to a safe condition, this gives our own troops a high level of manoeuvrability, as mined areas can be used by them but blocked to others," points out Mats.

Imagers

A further refinement that will materialise from the NMS system is the facility to use imaging sensors. From the presentation unit, it is then possible in real time to activate and trigger your mine weapons by viewing the current situation on the presentation unit's display. Imagers are very useful. Without such a function, enemy soldiers would be able to slip into minefields and clear them quite easily. The mines themselves can only detect vehicles, not foot soldiers.

The tactical officer initially receives the information from "his" minefield, but the point is that the information must also be able to be used in a wider perspective. For this reason, a number of tactical officers are linked to one battalion commander or equivalent, who can share the information received from all the minefields involved. The information is then "cascaded" up to higher authorities when needed. The aim is that it must be available right up to the national Network-Based Defence System, NBD. The refinement, therefore, lies in interested parties other than just the unit working around the minefield in question also being able to use information to solve various types of tasks. The information will be stored so that it can be shared with all those who have the authority.

Wireless

The NMS system is built on wireless duplex communication. The information from the mines and ground sensors is sent to one or more local nodes, which collect and compile the information. The local nodes have a range up to several kilometres and will be placed in several arrangements depending on the number of mines/sensor in the minefield. Reserve nodes will also be positioned, so that the system does not break down in the event of damage to a node. A normal-sized minefield will contain around 3 to 10 local nodes. The number of local nodes depends on how many mines/sensors are in position and how far away the tactical officer is from the mining. The tactical officer can obtain automatic updates from the nodes and also contact them when he or she wants to view the minefield.

Range

In order to link minefields to each other, remote nodes with a long range are used. These nodes make it possible, for example, to link minefields in Northern and Southern Norrland to each other. In order to send information over even longer distances and over several media types simultaneously, communication switch nodes are used. These are an NMS interface to NBD and enable other interested parties to share the information. In purely theoretical terms, it would also be possible to get the information to travel throughout Sweden if strategic nodes are positioned for this.

"But this would involve some delays, so it is not of primary interest to the combat task," explains Mattias. "The most important thing is that the information reaches the tactical officer quickly".

Demonstrator

At present, the NMS project is waiting for the starting signal. In 2006 a demonstrator installation will have been produced, equivalent to a system with at least two small minings and one battalion commander.

"It's quite a small system, but perfectly adequate for allowing control of the functions," says Mattias.

From a world perspective, the NMS project is high-profile. There are studies in progress on sensor-guided mine systems in every corner of the world, but when it comes to linking systems together with one overall command system, Sweden is way ahead.

Jerry Lindbergh

Definition of mining

Mining is part of delaying action. The purpose of mining is to inflict losses on the enemy, gain time for your own units and affect the enemy's advance in time and space. When mining, the aim should be to mix different types of mine. The proportion of the mix is determined by the intention level of the mining, restrictions and access to materials. Mining may have three different tactical/combat technical intention levels: disruption, delay or obstruction.

”With the grace of the King, I name this ship Helsingborg”

With pomp and ceremony, before 350 guests from ten countries, Minister for Defence Leni Björklund named the second vessel in the Visby series.

PETER NILSSON, KOCKUMS

“Instead of pulling down, we shall now be applying our energy to change and development,” said Minister for Defence Leni Björklund about defence policies and their much-discussed course. Leni is flanked by naval inspector Jörgen Ericsson (left) and Kockums CEO Martin Hagbyhn (right), who stand to attention.

“With the grace of the King, I name this ship Helsingborg. May good fortune remain with her at sea and may she remain a strong link in our defence,” said the minister, as the fleet’s new addition was christened.

At the launching of HMS Helsingborg, Leni Björklund expressed pride in what has been achieved by FMV, the Navy and Kockums. Her closing remarks were particularly appreciated, when she turned her attention to all those who have worked on the project, thanking them for their magnificent input.

Export concept

The navy band played in perfect time, the flag guard and guard of honour were in place and many Kockums employees had come to enjoy the ceremony.

Before the launching, the Swedish security concept for shallow waters was presented to 150 invited guests, with a large contingent of foreign experts present. The speakers included FMV project manager Thomas Engevall, who gave an address on “The Swedish maritime security concept and present status of the Visby class programme”.

Similar seminars have been held and future ones will be held on the export market. They have been arranged on the initiative of the Ministry of Defence, one of them recently in the USA.

Tune of the future

“This is a great day for Kockums as this is not just a new vessel concept, but the second vessel in a series of at least five,” said Kockums CEO Martin Hagbyhn. “Today we have moved from prototype to series production. The doubters, if there were any, can see that the concept of carbon fibre and stealth technology is the future way of building vessels for a maritime security concept”.

Kockums Chairman Hans-Joachim Schmidt said that German owner HDW is lucky to have Kockums, with stealth technology as a speciality, in the group. He added that HDW believes in this concept and is making vigorous efforts to market it globally. He then praised the partnership with FMV, pointing out that experts throughout the world are currently focused on stealth technology and its potential, which changes naval strategy. But the concept is only a reality here in Sweden, where it has been tested under tough conditions by HMS Visby, and has functioned better than expected.

HMS Helsingborg, decorated with flags on the ship lift before the naming ceremony and launching, June 2003.

PETER NILSSON, KOCKUMS

“This give Kockums the edge and we must exploit this as we now invest in the export market,” emphasises Schmidt.

Helsingborg

Like the other corvettes in the Visby series, HMS Helsingborg is built of carbon fibre and incorporates the total stealth concept, which includes everything that minimises signatures and signals with the aim of delaying and preventing detection and identification. She has been constructed for the minimum level of signatures and is therefore very difficult to detect by radar or with other sophisticated equipment. The vessels in the Visby series are flexible surface combat vessels with good seagoing qualities at both high and low speeds. They can also cope with minesweeping and submarine warfare, such as mining, surface combat, underwater defence and air defence. They also have very great capacity for reconnaissance, combat control and liaison. In other words, all in one.

Kjell Göthe

Submarine Södermanland in new garb

“The threat scenario confronting Swedish defence demands radical changes.We shall implement this process of change while ensuring that defence material maintains a high technical standard. The modernisation of HMS Södermanland is an example of this,” said Håkan Juholt, Chairman of the Swedish Defence Commission, as he launched the submarine on 8 September. Juholt added that over 50 percent of the Swedish defence budget is invested in research and procurement of materials and that the level will hopefully be maintained in the 2004 defence resolution. Other speakers at the ceremony included Kockums CEO Martin Hagbyhn and Rear Admiral Göran Larsbrink, Head of FMV’s joint procurement command.

20 years old

The submarine, built in the early 1980s, has been fitted with the Stirling air-independent propulsion system, enabling her to remain under water for several weeks. A new climate control system permits cooling/heating/dehumidifying of the air onboard and an installed divers’ decompression chamber allows entry and exit of divers while submerged.

A large number of advances in hydraulics, air systems, water systems and corrosion protection have also been incorporated. The submarine has been extended by 12 metres to 60.5 metres, increasing its displacement by 430 tonnes to 1,500 tonnes.

Jerry Lindbergh

PETER NILSSON, KOCKUMS

Test with heavy rockets on the J21 (1946) aircraft.

World-unique flight-testing history

Propeller fatigue (1945).

Centrifuge for components (1953).

Few countries have such a long history of flight-testing as Sweden. This year FMV's pride and joy in Linköping celebrates its 70th birthday.

Testing has always been a necessity for flight materials. In the infancy of aviation, all testing was done by the aircraft constructors themselves, but independent bodies soon appeared. FMV's flight-testing operations in Malmslätt outside Linköping began in 1933, when the Swedish Air Force set up a special research department at the Swedish Air Force Maintenance Depot in Malmslätt (CFM). The department was previously called the Research Centre (FC), a name it kept until 1974, when operations were placed under FMV, which had been formed in 1968. Between 1978 and 2001, the operations went by the name FMV/Testing and then took the present name VoVC (Validation and Verification Centre). The new name shows that operations do not consist of testing of individual parts in the materials structure of the Swedish Armed Forces, but verification and validation of the entire materials system, for delivery to the Swedish Armed Forces. A good example of a modern materials system is JAS 39 Gripen, which consists of aircraft, ground equipment, pilot equipment, weapons, combat control systems and various other features to permit optimum operative capacity. VoVC will have an important future role in developing the aircraft's air-to-air refuelling capacity.

Rocket test on armoured vessel (1956).

100 aircraft types

There have been numerous tests at what is now VoVC over the years, with around 100 different aircraft and helicopters having been test-flown or tested. These include J26 Mustang (1945), S31 Spitfire (1949) and around 15 Saab aircraft, with everything from B17 (1941) and AJ37 Viggen (1969) to the C version of JAS 39 Gripen (2003).

One of the first aircraft tested was the accident-prone SK 10 Tiger Schwalbe (1933), which would often go into an uncontrollable spin when flying inverted. When the research staff had done their job, the Head of the test-flight section performed 212 loop-the-loops in the aircraft with no problem.

Leading-edge technology

FMV's flight-testing has always been at the leading edge of technology. Even back in the 1930s, they could boast a wind-tunnel, an engine laboratory and equipment for strength testing on wing spars and bomb racks. In the 1940s, an environmental laboratory, with a shaking machine, cold room and humidity chamber, was put into service. In the following decade, a centrifuge for apparatus testing was purchased. It was also in the 1950s that computer aids began to be used for the first time, albeit on a small scale. In the 1960s, an electrical environmental laboratory was purchased, with screened rooms for testing equipment's resistance to electrical interference. The 1960s also saw the establishment of an aeromedical section, with low and high pressure chambers, climate chamber, testing pool and fire-testing site. In the 1970s, the telecommunications laboratory was set up, with the facility for advanced testing of electronics components. In addition to standard electronic equipment, high-resolution real-time x-ray equipment, a scanning electron microscope and equipment for microscopy, optronics and plastics analysis was also purchased. In 1971, the first computer equipment, for automated evaluation of test results, was acquired. It was a Hewlett Packard machine, with a primary memory of 16 kb, which was given an extra hard disk with a capacity of 5MB one year later.

JERKER GRÖNBERG

PIA ERICSSON

In popular speech, people still call the FMV's 70-year old flight testing operations the research centre (FC).

"Our test range is in a large-scale development process, driven by NBD, systems of systems and new technologies which also include the European Phoenix space shuttle project," says Per-Olof Eldh, FMV's test range manager in Linköping.

In 1980, an electronic warfare simulator was launched, in which duel simulation between threat systems and countermeasures was tested. One year later, the laboratory for electromagnetic pulses (EMP) was set up. This is where equipment's resistance to electromagnetic pulses from nuclear charges is tested. The premises can cope with full-scale testing of JAS 39 Gripen, for example.

The 1990s was the decade of the JAS 39 development with Robot 99 (Amraam) and FV2000, i.e. the new data link network for air combat control. Since the early 1990s, activities have also included modelling and simulation for systems of systems, for new NBD technologies and for flying platforms and airborne weapons.

Recent acquisitions include a dynamic flight simulator, which was delivered to FMV not long ago. Following training and certification of the simulator's operational organisation, training for Swedish Air Force pilots and research work by the Swedish Defence Research Agency (FOI) will soon get underway.

Clear stamp

The present VoVC's activities are characterised by future network-based defence (NBD) and by flight material which the Swedish defence is considering acquiring, is in the process of developing or has in service. The most prominent work has always been testing and system development (both in the air and on the ground), primarily of aircraft, unmanned aerial vehicles (UAV) and helicopters and their systems and apparatus.

One task which has grown in recent years is FMV's customer examination of defence material, mainly aircraft and helicopters and weapons with incorporated systems and apparatus, together with connected peripheral equipment and support systems.

This also includes monitoring of the industry's flight testing. Also important is monitoring of air preparedness in military aircraft and helicopters during testing. This activity consists in ensuring that the necessary operations and their documentation are implemented and also checking that technical data and hardware fulfil the defined requirements and contractual undertakings.

If operations were advanced in 1933, that's nothing to what they are now.

Jerry Lindbergh

With helmet as the sight

PIA ERICSSON

Michael Rosenquist before the first flight with the Flight helmet.

The western world got a bit of a shock at a Farnborough airshow in the late 1980s. When a Russian Mig29 pilot pulled down a monocle from his helmet, people realised that the Russians were way ahead of the west in helmet vision development.

To have some form of sight when firing a missile from an aircraft is a matter of course. However, the type of sight varies considerably among defence forces. The present Swedish fighters have a sight-line indicator, which is displayed on a screen above the instrument panel. The indicator shows when the aircraft is on a straight course to the target. The system functions well, but requires continuous correction of the aircraft's course to enable the pilot to get sight of the target.

Helmet sight

With a helmet-mounted sight, the target seeker and other information is projected inside the helmet's visor. The pilot aims by turning his head towards the target and so does not need to change course.

"You just fly past your target, turn your head and fire," says FMV flight engineer Dan Martelin.

Tests on this type of helmet have shown a time gain of several seconds over "conventional" systems. One implication is that an "inferior" aircraft with the helmet sight function performs better than an ultramodern aircraft with conventional sight technology.

Boost

The new helmet sight technology is a huge boost to the military sector, but would also benefit civil society. "Maybe in the disabled area," says Dan. "Instead of steering a wheelchair with voice or hands, it could be controlled with the head.

Three projects

FMV has conducted three projects in the helmet sight area. In 1992, the Oden project was launched, and its helmet gave optics, which, like a projector, showed the sight to an external coating on the visor. By using a magnet in the helmet and a sensor in the cabin, it was possible to detect the helmet's position and movements, so that the sight moved at the same speed as the head movements. However, the precision was not good enough to seriously consider investing in this solution. The Oden helmet was intended for use in close combat, i.e. at a radius of 1-3 kilometres, but after a series of test flights in Viggen, that was the end of it. The Oden project was abandoned, but it had provided valuable knowledge in an area worthy of future investment.

Other projects

The second of FMV's helmet projects began in 1998 during development of the IR missile IRIS-T/Rb98. The missile was designed to be combined with some form of helmet sight and "Guardian" was chosen to become helmet generation after Oden.

Guardian was last test flown in Gripen in summer 2002. It differs from Oden in the way it senses head movements. Instead of a measurement system with magnet fields, Guardian's position is determined by LEDs measured by two video cameras in the cabin. This gives much greater accuracy than did Oden's system.

"If you are about to fire at an enemy and a compatriot is nearby, the system must be precise, otherwise there is a danger of shooting down the wrong aircraft," explains Dan.

Detailed information

Guardian and Oden also differ greatly in information. The Oden helmet only projected the sight itself and the selected missile type on the visor, whereas the Guardian helmet can display all information that may be relevant in aerial combat. Examples

Continued on next page

PIA ERICSSON

200 kilos of electronics. The Flight helmet's solid test platform for the SK60 aircraft.

The Guardian helmet offers advanced technology and good precision, but weighs a whopping 1.8 kilos. This, plus powerful G forces, has been shown to put a real strain on the pilot's neck. Guardian was last test flown in Gripen in summer 2002.


SAABTECH

The sight (cross hairs) and relevant information are projected onto the inside of the helmet's visor.

include details of your own and the target's speed and altitude and the distance to the target. The information on distance also includes indications about earliest firing time and when to refrain from firing because of splinter risk from the shot-down target. Of course, this information depends on what ammunition the pilot is using. If the pilot changes ammunition, the information on the visor also will change.

Guardian offers both high technology and precision, but it is also heavy. Weighing 1.8 kilos, it is 500 grams heavier than Oden and this, plus the powerful G forces, has caused pilots to experience some neck problems. Another drawback of the helmet's heavy weight is that on occasions it has been prone to "slide" on the head, causing the picture to disappear.

Third project

In parallel with Guardian, FMV has also looked at three other display solutions, one with VRD technology, one with LCD technology for one eye and one with LCD technology for both eyes. These solutions were part of the ACE (Advanced Cockpit Evaluation) research and development project.


JERRY LINDBERGH

Dan Martelin, Aeronautical Operations and Maintenance Engineer at FMV.

Laser

The VRD helmet's technology involved a laser projecting the picture directly into the pilot's eyes. This was effective, but as the knowledge about the risks of laser radiation is still incomplete, the project was soon put on ice. However, it is believed that laser technology will have many applications in the future.

Sweden broke new ground with LCD technology for one eye (the Flight helmet). In the helmet, the picture is generated by liquid crystals (LCD), just as with flat-screen computer monitors, and projected onto the visor. The helmet is light and quite cheap compared with other alternatives and has a big advantage, as the LCD screen enables pictures to be put up directly onto the visor, taken, for example, from a thermo-camera outside the aircraft. The helmet's LCD screen takes up half the pilot's field of vision, i.e. one eye.

"In summer 2002 we were first in the world to test this type of imager," says Dan.

Surround sound

In the tests, which were carried out in the SK60 training aircraft, 3D audio and voice control was also tested successfully. These refinements had never before been tested in jets either. 3D sound (surround) means that the pilot hears directly where a warning is coming from. He can then react in a flash by turning the head in that direction and aiming at the relevant target. Voice control is there to relieve the pilot. For example, he can change map pictures by a voice command instead of having to press a button.

The helmet, with LCD for both eyes, is like the helmet with LCD for one eye, but has double LCD displays, which means that the whole visor and both eyes are covered by the picture/


MAGDALENA HAGELIND

As long ago as the 1800s, they were trying to produce helmets with a helmet sight. They tried by using a pistol mounted onto a cavalry helmet. The firing itself was done by the marksman blowing into a tube, which was connected to the pistol's trigger. According to Dan Martelin, Sweden was first in the world to think on these lines.

target sight. This is a commercial product and was originally developed for use in keyhole surgery. However, because of financial and time factors, no test flights were carried out with this helmet.

Future

Important questions which must be considered when evaluating future helmets include weight, balance, picture on one or both eyes, light reduction in the visor (e.g. against the sun) and one or more multi-colour visors.

With its experience from Oden, Guardian and ACE, FMV is now moving towards a Swedish series purchase of helmets with helmet sight. Research is important in achieving the best solution. The success concept also includes good business intelligence. Russia, South Africa and Israel are countries which currently have unit experience of helmet sights.

"The Swedish project will hopefully produce a helmet which combines Oden's weight, the Flight helmet's imager and Guardian's measurement system," concludes Dan.

Annika Sundin


PER HALLIN

Brimming with technology

At first glance, it doesn't look much, but the HKOM plug is actually the most advanced hearing protection ever.

Protecting the hearing is one of the most difficult problems in military operations. The noise level in combat vehicles is constantly high and the racket when firing weapons is not welcome to any eardrum. At present, ear defenders protect the hearing, sometimes in combination with earplugs. This certainly provides good noise protection, but communication between soldiers suffers.

With the Norwegian Armed Forces, FMV is now well on the way towards developing intelligent hearing protection with short-range communication. The project began in 2001 and is called HKOM.

HKOM hearing protection is not just an earplug that can reduce, amplify, discern and filter sound. It is also a piece of communication equipment which enables soldiers to communicate with each other in a radius of 300 metres. The hearing protection's advanced technology and minute size make it world-unique.

"At the present time, you cannot get the functions offered in this tiny plug in the same earplug, not even in the most sophisticated ear defenders," says Per Hallin, FMV's technical manager for the project.

"It was our intention to start the project prior to 2001, but it was only when technology became advanced that it was possible to get it down to the size we wanted," adds FMV project manager Jan Nee.

Continued on next page


MAGDALENA HAGELIND

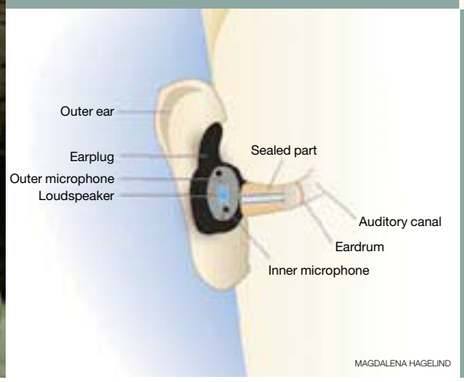
The HKOM hearing protection opens up a new world to the soldier. The tiny earplug contains hearing protection, a hearing aid and communication equipment. The radio unit and hearing protection control unit worn on the soldier's chest will be built into one unit. It will be a group type radio, which means that everyone can talk to each other at the same time, more or less like a conference call.


JERRY LINDBERGH

These small ear-plugs contain more technology than it has previously been possible to integrate into advanced ear defenders.

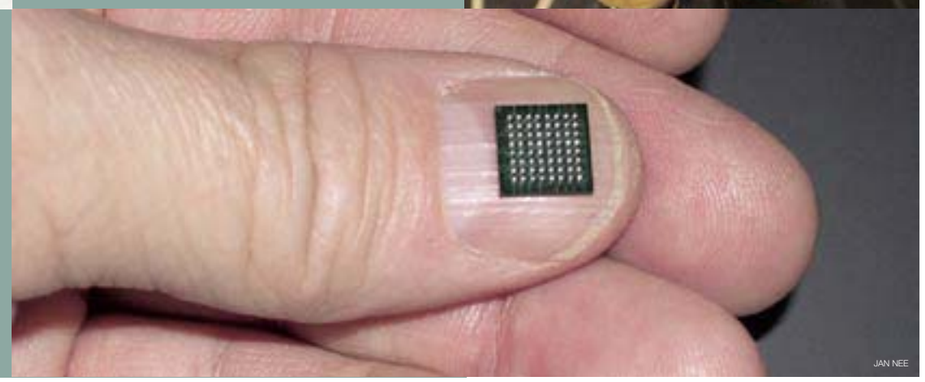
Jan Nee and Per Hallin show the first proto-types of the HKOM intelligent hearing protection.


JERRY LINDBERGH



MAGDALENA HAGELIND

Two tiny IC circuits are the HKOM hearing protection's intelligence. To put into them everything from noise filtering to communication equipment is what makes the project unique.


JAN NEE

Inside the HKOM plug is an electronic unit containing two small microphones and a loud-speaker. The outer microphone picks up the sound outside the earplug. ASIC circuits in the control unit analyse the sound and if the plug's own passive noise suppression of 20 – 30 decibels is not sufficient to reduce the noise to a harmless level, the control unit balances out the harmful noise using advanced signal processing. This is done by the ASIC circuit generating a soundwave in reverse phase to the noise. This soundwave is emitted from the loudspeaker in the auditory canal. In this way, the harmful sound is eliminated. The function is completely digital.

However, speech can enter the auditory canal, as we have "taught" the earplug which sounds and frequencies are to be allowed past or blocked. "It's also important to teach the plug what is harmful sound and what isn't," says Per. "It's a major job, as both sound and speech come in many guises".

During extremely high impulse noises, from, say, artillery fire or recoilless rifles, the plugs need to be supplemented with normal ear defenders to achieve adequate noise suppression. The amount of noise to which the wearer is exposed over a certain period can be measured, to determine when the wearer has achieved the maximum noise dose and needs to rest the hearing.

Amplification

The HKOM plug can also be used as a type of hearing aid. By turning up the volume on the control box, the sound around the wearer can be amplified considerably.

"This is required, for example, during reconnaissance work," explains Jan. "If you turn up the volume, an intruder can be heard at an early stage. The plug will still reduce the volume if the noise becomes harmful".

However, the most spectacular feature is the built-in microphone solution, which makes the HKOM plug a top-class communication radio. For communication with other soldiers by radio, mobile phone or similar, the inner microphone is used to catch the user's speech in the auditory canal.

"The microphone picks up the wearer's speech through his or her throat and auditory canal," explains Per. "This means that soldiers can communicate with each other without their speech being mixed with the noisy environment".

The plug picks up speech the back way "through the head" and then sends it down to the control box, which passes it on to other soldiers involved via the short-range communication radio. The equipment is so sensitive that even whispers can be picked up. Communication can be controlled with a voice command or in the traditional way with buttons on the control unit. The voice command functions, whatever the current noise situation.

The HKOM equipment can be connected to different types of communication systems. FMV is purchasing two types of short-range radio systems in the project. The basic requirements are full duplex, the capacity for eight simultaneous users and a range of at least 300 metres. HKOM can be connected to a number of radio or intercom systems, including mobile phones.

"This communication solution is revolutionary, particularly for those working with protective masks," says Jan. "Now there is no need for external microphones or lifting the mask to communicate. It will become easier and safer to carry out tasks, whatever the duties might be. Many people are in an environment in which they require hearing protection, yet still need to communicate".

Some development and a number of tests still remain before the HKOM hearing protection can be acquired for the Swedish Armed Forces. In late autumn 2003, a number of hearing protection prototypes will be produced and these will be used to test how the equipment feels when worn for longer periods.

"Those of us who have worked on the project have got used to having things in our ears, but for a newcomer it can be a nuisance," says Per. "That's why we shall be producing several different sizes, so that people can find a plug to suit them".

Requirements

With the help of various pieces of laboratory equipment, performance expectations for the hearing protection are already known. There is no doubt that they will fulfil the requirements specified by the Swedish Armed Forces. The requirements are based on the civil rules of the Swedish Board of Occupational Safety and Health, which means that military personel must not run a greater risk of hearing damage than a civilian employee.

The project's first hardware delivery is in late autumn 2003. Equipment will be tested on a large number of soldiers throughout Sweden during the course of 2004. "We shall be visiting all the noise situations we find in defence," says Jan. "We are concentrating on noise environments around the Combat vehicle 90 and recoilless rifles. That's where the worst constant noise is found and the army's most dangerous impulse noises".

When the tests have been completed in 2005, it is expected that around 3,000 HKOMs will initially be purchased, including some form of short-range radio.

Jerry Lindbergh

FMV displayed the HKOM project at the CIMI Fair in Enköping from 20 – 22 May 2003. A demonstration showed noise protection of today and of the future. On the stand there was a mobile noise simulator which could reproduce the noise situation experienced when travelling in the Combat vehicle 90, for example.

MAGDALENA HAGELIND

Rakel in control of communication

The security authorities, such as fire brigade, army and police, have needed a common radio communication system for a long time. Rakel (radio communication for effective management) has made this a reality.

The government has earmarked SEK 2.3 billion for the development and operation of a new, common radio communication system for Sweden's security authorities. The new system has many advantages. There are at present some 200 different radio communication systems in the protection and security sector. This means that the systems do not just differ from authority to authority, but often also within the same authority. This, of course, is asking for trouble. For example, a police patrol can lose radio contact with its home station when it has to operate in a county which is not its own.

JERRY LINDBERGH

FMV's assistant task manager Christer Thorsson and task manager Jan Wallin.

Interference is another common problem with the present systems. At the EU summit in Gothenburg in 2001, the police's radio communication systems were affected by such strong interference that the head of operations at Vasaplatsen was often unable to achieve radio contact with the 700 police in the surrounding area.

The fact that the systems lack good encryption, which protects against radio monitoring, is a problem not only for the police, but also the ambulance service. When an ambulance is coming in with a patient and needs to give sensitive information to the hospital, a mobile phone is often used, as it is far too easy to monitor radio. Today the mobile phone has become a necessary complement to the radio communication system. This is not a good solution, as the handling becomes more time consuming and the mobile networks are sensitive to factors such as overloading.

Solution

During the last ten years, the need for a new, common radio communication system has become increasingly apparent. In Rakel, Sweden's security authorities will have a standardised radio system covering the whole country, with the exception of mountain areas not connected to main roads. A police patrol will then be able to maintain contact with its home station, wherever it is. The patrol also can request reinforcements from any other police station and from the other security authorities. As the system is only designed for the security authorities, there is no risk of it becoming overloaded, which is what happened with the world's public mobile phone systems during the catastrophic events of 11 September 2001.

Offers

The government has ordered FMV to procure the Rakel system. In autumn 2003 requests for quotation was sent to qualified tenderers and quotations was received from potential suppliers. As FMV defined as many as 1,000 mandatory technical requirements and 500 recommended requirements in the request for quotation, 210 questions were received from the prospective suppliers.

"Each question and answer has been examined carefully and circulated to all interested parties in such a way as not to reveal the suppliers' identities," says FMV's task manager Jan Wallin. We shall now evaluate the quotations and various documents until March 2004".

Base stations

To enable Rakel to obtain the planned mass coverage, the system will use around 1,800 base stations located throughout Sweden. Most of these already exist as part of the Defence telecommunications network and other authorities' base stations. Each base station will need to be fitted with new radio equipment. The same applies to all police cars, fire engines, ambulances, military vehicles, terminals etc. In total, it is expected to produce and install between 30,000 and 50,000 radio communication receivers.

"This means an initial non-recurring fee, but when everything has been installed, the system will not cost the authorities any more than their present systems," says Jan.

Rakel will be introduced by county in seven stages. The first stage includes Skåne, Blekinge and Kalmar and will come into operation in November 2004. The system will then be extended over the country, ending with Norrbotten in 2009.

Jerry Lindbergh

MAGDALENA HAGELIND

The requirements of the Rakel system are as follows:

- Short switching time
- Capacity to handle telephone calls, emergency calls, conference calls and data transfer
- Allow calls between users in the field, without connection to infra structure (walkie-talkie principle)
- Encryption to protect against monitoring
- Compatibility with other systems, e.g. GSM
- Capacity to continue operating during power failures
- Facility to offer positioning services

Authorities included

- Police
- Swedish Coast Guard
- Municipal rescue services
- Ambulance service
- Swedish Armed Forces
- Swedish Customs

VESA TOIVONEN, PATRIA WEAPON SYSTEMS

SSG 120 now also on the water

The splinter-protected 120-mm mortar system, which in recent years has undergone trials on a combat vehicle 90 chassis, has now been moved to a combat boat 90.

This is because the Swedish Armed Forces has asked FMV to ascertain whether the SSG 120 system may be of interest to the Navy. This all represents a step towards a cost-effective conformity in the Swedish Armed Forces. Some changes have been necessary for the turret to fit the water-borne demonstrator boat.

"One thing we had to do was move down the operators' seats in the hull, so that the turret is now manoeuvred by remote control," says FMV's project manager Ulf Öberg. "We also have upgraded the firing control equipment and aiming system to allow firing during the voyage. You generally stand still for indirect fire or artillery fire, but at sea you are always moving".

On 11 – 12 November 2003 in Gothenburg, the new demonstrator boat was shown to the press and other interested parties. Eight shots were fired at a speed of 10 – 20 knots. The target distance was 1.8 – 2.4 kilometres and all shots landed within an area of 50x50 metres.

Jerry Lindbergh

FMV
TECHNOLOGY FOR SWEDEN'S SECURITY

For more information about the Swedish defence materiel administration (FMV), visit the English website at www.fmv.se