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# The Making of Terne

The First Norwegian Weapons System  
1953—1962

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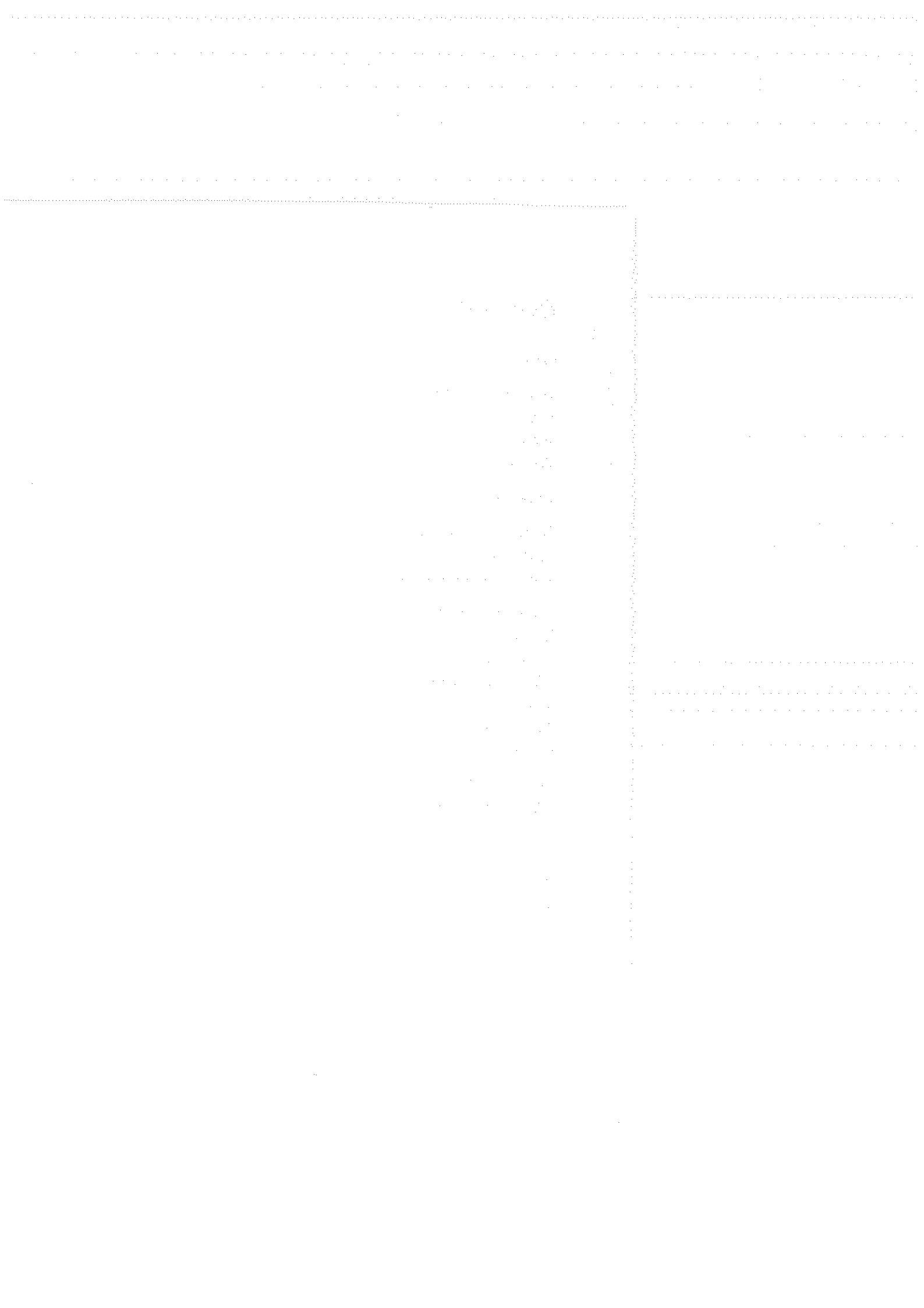
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## Contents

	Page
Introduction .....	5
Terne and the NDRE .....	7
Terne's ancestors .....	7
Terne III - the true Terne project .....	9
The shaping of NDRE .....	11
Terne and the Navy .....	14
Terne and the Americans .....	17
Applications for development and production support .....	18
The U.S. contributed with more than money .....	21
Terne and Kongsberg Våpenfabrikk .....	23
KV and Norwegian military industry before Terne .....	23
KV's capacity .....	24
Why did the NDRE pick KV as main contractor? .....	27
Why did Møller and Hauge pick KV? .....	31
The production at KV .....	32
Changes of the prototype .....	33
The sale of Terne .....	34
Why did Terne not sell? .....	41
Conclusion .....	44
Sources .....	48
Bibliography .....	49
Abbreviations .....	50
Notes .....	51



## Introduction

For a short period during the 1970s Norway was among the ten most important weapon exporters in the world,<sup>1</sup> largely as a result of the sale of Penguin missiles from Kongsberg Våpenfabrikk (KV). This state of affairs is relatively new to Norway and to the state owned KV. Until the late 1950s practically the only Norwegian weapons sold abroad was the Krag-Jørgensen rifle. The development of the anti-submarine weapon Terne was an important step in the modernization of the Norwegian weapons industry.

This article is about the development of Terne at the Norwegian Defence Research Establishment (NDRE) and at KV. My focus is administrative and organizational – not technical. The weapons system was developed without any pressure from «the outside world». Nobody ever asked the NDRE to develop this weapon. Consequently much of the development work at the NDRE consisted of the raising of funds and goodwill. And the researchers were successful in their task; in the very beginning not even the Navy wanted the Norwegian anti-submarine weapon. Ten years later, there were strong advocates for the weapon in the Storting (Parliament), in the Defence Department, in NATO and in parts of the US bureaucracy.

I have chosen the decision-making process as the most interesting aspect of the Terne development. Yet, Terne was also important in many other ways. Both at the Norwegian Defence Research Establishment (NDRE) and at Kongsberg Våpenfabrikk (KV) the Terne project was succeeded by other more well-known projects, for instance, the Penguin missile system. The director at KV, Bjarne Hurlen, once described the Terne project as a «crowbar» for the company.<sup>2</sup> In a speech in 1980, Hurlen mentioned the new process thinking that was introduced as a result of Terne, being instrumental in contributing to the fundamental revival of KV.<sup>3</sup>

At the NDRE the Terne project also introduced a new way of thinking and working. The project was so big as to necessitate a hitherto unprecedented level of cooperation between the different departments in the Establishment. The NDRE staff also gained experience in project management with Terne. Last, but not least, the Terne system introduced much new technology. Both KV and the NDRE acquired competence in

the field of electronics. The weapons system consisted of advanced sonars, fuses and computers. The people developing and producing Terne acquired skills that were to be essential in the making of other products when the Terne project was finished.

## **Terne and the NDRE**

The most obvious reason for the development of a new weapons system is that there is a need for the weapon. At the start of the cold war there was a need for practically all kinds of weapons. The anti-submarine weapons developed and used during the war were no longer of adequate quality. The hit probability was below 15 per cent and the weapons systems were also too heavy for the relatively small Norwegian naval vessels. As a response to the technological challenge, and in particular the political challenges, the Storting granted an additional NOK 100 million to defence in March 1948. From 1950 to 1954 the defence budget was more than doubled in response to international developments.<sup>4</sup>

In spite of these facts, neither Navy officers nor officials in the Ministry of Defence asked the NDRE to develop an anti-submarine weapons system. In the first couple of years after the war the Norwegian government did not want to purchase weapons because civilian needs were greater. From 1949 and throughout most of the fifties Norway got most of the weapons it needed from the United States (Military Assistance Program). As long as the Norwegian Ministry of Defence did not buy Norwegian equipment it was unlikely that Norwegian weapons would be developed. The reason why Terne was developed is therefore to be found inside the NDRE. The researchers at the NDRE made an independent decision to develop the Terne project. The remaining part of this chapter is therefore devoted to the process of decision making within the NDRE.

## **Terne's ancestors**

When asked in January 1954, the director of the NDRE, Fredrik Møller, did not remember who had initiated Terne. He recalled a meeting with one of the branches of the Navy before 21 February 1950 where the Terne project was discussed. He recalled in particular that «the main object of the discussion was which branch of the Navy should be in charge of the new weapon.» He remembered well the conclusion: «The Artillery should be in charge of the missile when it was in the air and then the Torpedo and Mine service should take over when the missile hit the water.»<sup>5</sup>

It is possible to determine the age of the Terne weapon in at least two ways. The weapons system that was to be installed on naval vessels dates back to the early 1950s, but the work on the first projects leading up to the Terne system began in 1947.

The first of these projects was a rocket-driven diving mine called Terne I. 100 such rockets were produced and used in various tests. The technology very much resembled that used in the later Terne systems.<sup>6</sup>

The NDRE department in charge of Asdic (the original name of sonars named after the Allied Submarine Detection Investigation Committee which developed the sonars during the war) started up after the war on a project to develop sonars for securing the harbours. In all 19 stationary harbour sonars were made in the late 1940s.<sup>7</sup>

The combination of the harbour sonars and Terne I produced Terne II; a weapons system for use against submarines attacking harbours. It is unclear how the idea of Terne II originated. The «normal» procedure would probably have been that the potential user of the weapon (the Coast Guard or the Navy) asked for the weapon and then defined requirements and specifications. In our case it was the NDRE which defined the specifications of Terne II and the Navy corrected the specifications in December 1950.<sup>8</sup> It appears that the initiative lay mostly with the researchers at the NDRE. Even though the Navy corrected the specifications for the weapons system, these corrections were not essential.

Terne II was the first weapons system developed at the NDRE. It became the largest project at the NDRE in the early 1950s.<sup>9</sup> It was important for the Establishment because it necessitated cooperation between different departments inside the NDRE, because it was a purely military project and finally, because the NDRE had to acquire knowledge about servomechanisms.<sup>10</sup> A servo system means that there are at least two independent parts which constantly influence each other. In this case, a computer constantly changed the position of the weapon based on information from the sonars. Terne II was never fully completed. I shall discuss the failure to complete the project later; at this stage we simply make note of the fact that one of the reasons was that Terne III emerged as a bigger, more prestigious and more important project at the NDRE.



## **Terne III - the true Terne project**

The official starting date for the Terne III project is 3 January 1953. That day the steering committee for the Terne II project decided that the NDRE should start the preparations for Terne III. In the minutes from this meeting there are no explanations as to why the steering committee decided to start the new project. The only thing mentioned is that the undertaking of the Terne III project should not cost more. The development of Terne II should continue and the money already granted for this project should also cover the development of Terne III. At this stage the decision-makers regarded Terne III as a natural successor of Terne II. After trials with Terne II in Vestergapet (close to Kristiansand in the southern part of Norway) the researchers wrote that «because all the parts in the weapon are so light, there should be nothing to prevent us from putting the system on board even very small vessels.»<sup>11</sup>

The first in-depth discussion of the true Terne project was in the spring of 1953. The discussion concentrated on the priority to be attached to Terne III at the expense of Terne II. Erik Klippenberg (then researcher in the Physics department of the NDRE) discussed in a report of April that year the continuation of work on Terne.<sup>12</sup> He gave the steering committee three options:

- «a) The work on Terne III continues at full capacity. Nothing more is to be done with Terne II until the Navy has taken a decision about the harbour defence installation.
- b) The Terne II development is discontinued pending the decision of the Navy. The Terne III work continues at full capacity, but the NDRE is aiming to install the system in even smaller vessels than the proposed Sleipner-class. In that way (...we...) utilise fully Terne's light weight and the vessel can serve as a mobile defence system for the harbours and can supplement the stationary systems in the important harbours and replace them in harbours where it is too costly or inconvenient to install Terne II.
- c) The NDRE and the Coast Guard are cooperating in making the harbour defence system in Kristiansand operational as soon as possible. Work on Terne III continues to the extent allowed by the development of Terne II.»

Klippenberg was in favour of the third proposal. His main argument was that this solution made it possible for some of the systems to be operational pretty soon. «Given the mood within the Navy, this ought to be an important consideration.» Klippenberg also argued that the development of Terne III would be more time-consuming and expensive than originally planned.

The steering committee for Terne II accepted Klippenberg's advice, but it also decided to let three researchers (Klippenberg, Thorvald Gerhardsen and Thomas Krogh) examine the need for Terne III. This study, on the needs and requirements for a shipborne Terne II was to be «presented to the Navy before the Establishment starts building the prototype».<sup>13</sup> The group of three realized early on that it was necessary to study thoroughly the requirements for the development of Terne III. The study was therefore accorded high priority.<sup>14</sup> In other words the NDRE decided to single out both Terne II and Terne III as high priority projects. Today, this may seem to be a contradiction, but it would appear that the NDRE at the time did not perceive any such contradiction. Anyway, the priority question was solved in the summer of 1954. But it was not the NDRE alone which took the decision. As will be shown later, unexpected financial aid from the U.S. crucially influenced the decision by the NDRE.

An important part of the study made by the three researchers was the assessment of the already existing anti-submarine (A/S) weapons. The conclusion was clear: «For ships which are too small to be fitted with Squid (British anti-submarine weapon ed.) and for ships with A/S work as a secondary duty, no satisfactory solution has been found in existing shipborne A/S weapons. It is the opinion of this Establishment that the specific problems of modernizing the A/S installations in the Norwegian Navy can only be solved through a program for new construction of equipment.»<sup>15</sup>

The assessment of the work required was modest: between 15 and 20 researchers were required for 2 or 2 1/2 years. In addition to the normal budget of the NDRE the researchers asked for an additional NOK 1 million. The administration at the Establishment was basically satisfied with the study and it sent a formal proposal to the Navy. The assistant director, Danielsen, wanted, however, an even better documentation of the need for a new weapons system. «To justify for ourselves the undertaking of such a great task and to have a basis for asking for funds from others, there must be an assessment of our possibilities of acquiring the weapons needed from abroad.»

The Chief of the Navy and his staff discussed the proposal from the NDRE in a meeting on 4 May 1954. It was decided to establish a «building committee» and Thorvald Gerhardsen was appointed leader of the project. Gerhardsen resigned as project leader in the summer of 1955 because he did not agree with the head of the NDRE on «several questions» concerning the development of the project.<sup>16</sup> Apart from these problems it seems that Terne III was developed without any great problems from the summer of 1954 until the turn of the year 1956/57.

## The shaping of NDRE

Most of the employees at the NDRE had been engaged in military research for the allies during the war.<sup>17</sup> Many of them had done their research in electronics and sonars. The Terne development was therefore a «natural» continuation of the wartime research for some of the people at the NDRE. But the researchers had many options after the war and in at least two ways the Terne projects were not «natural» projects for the Establishment:

1. Terne was purely military.
2. Terne was a larger and more complex project than was usual in Norway.

One of the established goals for the NDRE when it was set up was that the work done at the Establishment should also benefit civilian society. The director, Fredrik Møller, emphasized that the employees «should not only work for singularly destructive ends.»<sup>18</sup> When the organization of the Establishment was mapped out, many of the researchers wanted it to be like a University some of them even wanted a principal or a dean. Møller once recalled that the Minister of Defence, Jens Christian Hauge, was the one who decided that the NDRE should have a purely military or industrial organization.<sup>19</sup>

Even though the NDRE spent much time arguing the case for the Terne projects, no one ever suggested that these weapons systems would benefit civilian research or industry. The advocates of Terne thought of them as purely military projects. The most obvious reason is that international tension and the developing cold war convinced the researchers that

military research was an urgent priority. The feeling that military research was becoming more and more important was so obvious to the researchers at the NDRE that they did not even write it down. Finn Ørstavik in his study of the NDRE emphasises the war background of most of the employees.<sup>20</sup> Most of them had been actively fighting to win the war – now they continued fighting just as hard to win the peace. To defend and develop Norway was more important than anything else. Because of this attitude within a military structure, it is likely that the people at NDRE felt that pure military research was the only possibility.

The researchers who wanted to do more science or who wanted to do research with possible civilian spin-offs disappeared after a while from Kjeller and Horten where the Terne projects were carried out. A more homogeneous staff contributed, of course, also to a purification of the work and the goals.

Why then develop such a big project as Terne? Finn Lied, director for many years at the NDRE, has written that Terne showed «that we were able to do something «big». We became a large institute carrying out large projects in contrast to so many other institutes in this country which became large for so many small projects.<sup>21</sup> Until then, researchers in Norway had been looked upon as «lonely eccentrics,» according to Gunnar Randers.<sup>22</sup> He was one of the researchers at the NDRE who started «thinking big». His nuclear reactor research was removed from the NDRE for political reasons,<sup>23</sup> but he was among the three most important founders of the NDRE. He himself wanted to move to the US after the war because the conditions for research in Norway were, in his opinion, very poor. Having received relatively large grants from the Ministry of Defence he decided to stay in Norway and to build the first nuclear reactor in any small country.

Randers and his friends at the NDRE possessed a fair amount of self-confidence. They had been affiliated to some of the most well-known research institutes in the world. Moreover, they and their fellow researchers abroad had shown that military research was of great importance during World War II. Sonar, radar and the nuclear bomb were only some of the results of wartime research.

The war changed the mentality of the researchers and they got more money from the Norwegian Ministry of Defence. Of significance is also the fact that technological development made larger projects necessary. Weapons systems and nuclear reactors were complicated systems – consisting of many components and techniques.

Today Finn Lied argues that the Terne project started an integration process at the NDRE.<sup>24</sup> It might be the case that this integration was one of the intentions of the people responsible for the Terne projects. During the first ten years after the war the administration of the NDRE was weak and the departments pursued their own interests. The first leader of the Terne project, Gerhardsen, complained in 1954 that the administration of the NDRE did not express clear priorities and only took a point of view when it was forced to do so by sharp conflicts between the departments.<sup>25</sup> The disintegration was obviously a problem for others besides Gerhardsen, but the need for a more united Establishment is never cited as a reason for the development of the Terne project.

## Terne and the Navy

The Navy knew after World War II that existing anti-submarine weapons were not good enough. The Asdic and Radar Inspection notified the Navy Headquarters of the need for new anti-submarine weapons in 1949 but the work at the NDRE was not mentioned in this notification.<sup>26</sup> It is not fair to deal with the Navy as a single institutional actor; the attitudes towards the NDRE were different in the different branches of the Navy. In general it is fair to say that there was a cultural conflict between the older Navy officers and the young researchers at the NDRE. «The advanced and independent position that is given the Defence Research Establishment within the Armed Forces *can* result in the armed services being force-fed with weapons whose value in a military respect does not correspond to the expense involved.»<sup>27</sup> This quotation from the Mine Service in the Navy illustrates an attitude towards the NDRE that most Navy officers retained until the late fifties.

Two other examples should be mentioned. The first concerns the Terne II project. One of the reasons why this project was never completed was a lack of confidence in the NDRE on the part of the Navy. After the first trials with Terne II in Kristiansand the researchers considered the weapons system nearly finished. In fact the fuses were too poor and the sonars did not measure the depth of an approaching submarine.<sup>28</sup> But the people at the NDRE felt that these were minor problems, and they expected to solve them during the production period. This attitude – that a weapons system was good enough for production even if it did not work – provoked Navy officers. The assistant director at the NDRE, Reidar Danielsen, was aware of this problem. In July 1954, he argued for the completion of Terne II before any work started on Terne III. It is important «both inside the Establishment and to the outside world to show that we can accomplish a task,» Danielsen wrote.<sup>29</sup>

The other example dates back to the fall of 1954. The leaders of the Terne project had – together with Navy officers – discussed the concept of the new weapons system with British experts in the Admiralty. The British were not impressed. Both the calculations of hit probability and the estimates of weight were disputed. The officer in charge of the Torpedo service, Bjørn Erling Ytterhorn, promptly asked the Navy Headquarters to

stop «spending money, time and manpower on the project Terne III. One should instead concentrate all efforts on the superior and completed weapon Squid (British anti-submarine weapon ed.)»<sup>30</sup> This was after the Navy's formal approval of the Terne project, and Ytterhorn himself had participated in the first steering committee meetings. More than anything else, it shows that the original support of the Navy was only formal and superficial.

In the coming years the Navy became more and more devoted to the Terne project – and to a certain extent to the NDRE. During 1955 and early 1956 the building committee (which was now the steering committee for the Terne project) was enlarged with three Navy officers. It is not documented why the committee was expanded – nevertheless the result was that the Terne project was given more profound and broader support. It was particularly important that Commodore Knut Blich became a member. He was in charge of the technical department in the Navy Headquarters and was part of the Navy leadership. He had a genuine interest in all aspects of the Terne project. He was the one who complained about the lack of leadership in the steering committee. After Gerhardsen's resignation it took more than one and a half years before his successor took over.<sup>31</sup> During this period the administration of the NDRE took care of the project itself. Blich and the officer in charge of the Asdic service, Commander Jens Sele, became such strong supporters of Terne that they themselves worked actively to gather support for Terne outside the Navy.

Why did the Navy soften? There is one, predominant answer; the Navy did not pay very much for the weapon development at the NDRE. Two days before the building committee was established (4 May 1954) it was clear that the U.S. was willing to sponsor much of the project. The NDRE asked for NOK 200,000 – assistance from naval ships and «an active interest» when they formally asked for support from the Navy in March 1954.<sup>32</sup> At this time the Navy had the power to veto the project. One of the conditions for the U.S. support was that the Navy wanted the weapon. The Navy had for many years complained because they felt that the other services got more money from the Ministry of Defence. It would have been more than strange if they refused to support the development of a weapon they needed as long as most of the development costs would be covered by others.

As the Terne system developed, the Navy became more and more committed to the project. Sustained financial and moral support from the Americans was obviously important but I will also argue that the

incorporation of the Navy officers in the steering committee generated enthusiasm among those involved. The Navy started sharing responsibility for the Terne project.



## Terne and the Americans

American financial and moral support was a prerequisite for the development and the production of Terne. The director of the NDRE, Finn Lied, said in 1958 that the Terne project would not have been completed had it not been for the Americans.<sup>33</sup> When the Minister of Defence briefed the Government on the Terne project in January 1959 he said that «if the production costs were to be met within the limits of the defence budget, it would not be justifiable from a military point of view to stake such large amounts on this project.»<sup>34</sup>

These quotations can be verified by the fact that the budget of the NDRE was small in comparison to the total cost of the Terne development. In 1954/55 it was a little over NOK 5 million, whereas the first grant from the US to the Terne project amounted to NOK 2,3 million. I have already mentioned that the Norwegian military in the fifties got most of their weapons from the US and against that background it is unlikely that the Ministry of Defence would have given extra grants to the Terne development.

It is also worth mentioning that the Norwegian Government never granted Research and Development contracts. «It is unfortunate that Norwegian industry is without the encouragement and the direct State support that our competitors abroad have benefitted from for generations,» the director of KV, Bjarne Hurlen, wrote in 1966.<sup>35</sup> During the fifties it was a rule that Government offices should buy Norwegian products if the price was less than 10 per cent more than the cheapest foreign product.<sup>36</sup> Most leaders of industry found this rule inadequate and they asked for a more generous policy. «The big State companies, which through insight and understanding, ought to lead in the development (of the electronics industry ed.) don't do it,» it was stated in a report from the Royal Norwegian Council for Scientific and Industrial Research (NTNF) in 1963.<sup>37</sup> Clearly, leaders of industry complained because they wanted more money, yet there is no doubt that Norway was without a general technology development policy that could have benefitted the Terne project.

A few words about the American support system is necessary. The Mutual Weapons Development Program (MWDP) was a minor part of the total U.S. programme of extending weapons and money to Europe during the fifties. In all, Norway received 47 per cent of her defence equipment in

the period from 1951 to 1967 in the form of direct aid. The weapon aid in this period amounted to NOK 6,3 billion.<sup>38</sup> The size of the MWDP is more uncertain, but until the beginning of the sixties, the NDRE received NOK 35 million.<sup>39</sup>

## **Applications for Development and Production Support**

The NDRE presented their projects to the Americans for the first time on 10 December 1953. It was the director of the NDRE who contacted the American Embassy in Oslo (the Military Assistance Advisory Group, MAAG) after he had heard some rumours about the new assistance program. In connection with the presentation of the Terne project, the NDRE applied officially for American support to the Terne project and another project - «Engsmelle» (an electromagnetic fuse for 81" bombers).<sup>40</sup> The Americans needed four months to make the decision, but on 2 May 1954, the NDRE was notified that the U.S. wanted to sponsor the «completion» of Terne with NOK 1,400.000.<sup>41</sup> Terne was at this stage far from completion, but the NDRE gave the impression that the Terne project was more mature than it actually was since that was one of the conditions for the MWDP support.<sup>42</sup> The MWDP also supported the Engsmelle project. The agreement was signed on 31 May.

Developing the system was both more time-consuming and more expensive than expected in the first contract. In the fall of 1955 the NDRE applied for more money and extended time limits. An increase in employment and materiel costs combined with insufficient capacity in the workshop were cited as the main reasons for the new application.<sup>43</sup>

The Mutual Weapons Development Team (MWDT), which was in charge of the MWDP, gave a positive reply but they were not completely satisfied with the Norwegian application. «...(I)t would be helpful if you would submit more concrete information, particularly with respect to the increase in development costs... Our own analysis of the progress reports which you have submitted on Terne III suggests that the increase in development costs are mainly attributable to important design modifications which have been made in the course of the development work, and which will result in a weapons system which is much improved over the

one originally planned.» MWDT further suggested five possible improvements of the Terne system. They asked the NDRE to write a new application.<sup>44</sup>

In other words, the MWDT actually prepared much of the application for the Norwegians. In the next and final application from the NDRE it was stated that the extra costs and the delay were «mainly caused by important design modifications being made during the course of the development work. These modifications will, however, result in a weapons system materially improved over the one originally planned, and it is felt that the improvement is of sufficient magnitude to fully justify the delay that is now becoming apparent.»<sup>45</sup> Two months later the Americans accepted the delays and granted an additional USD 143,000 to the Terne project.<sup>46</sup>

There is no doubt that the Terne system at this time was better than the one planned in 1954. Some of the «improvements» were at the same time necessary changes to the original plans submitted in 1954.

Even though the MWDP paid for the development of Terne, it was not obvious that the Americans should pay for the production of the weapon. In the beginning of 1957 there were signs that a foreign country wanted to buy three Terne weapons.<sup>47</sup> The documentation does not indicate whether the country in question was the U.S., nor does it refer to the manner of payment. At the end of 1957 the NDRE asked KV and another sonar equipment company (SIMRAD) to work out a price for the production of Terne - it was implied that the U.S. wanted to pay for the production.<sup>48</sup>

It is not clear why the NDRE contacted KV and SIMRAD at the end of 1957. In January 1958, the deputy-chairman of the board at KV, Jens Christian Hauge, met the leader for the MWDT, General Larkin, in Paris and told him that Norway intended to apply for support for the pilot production of three Terne weapons. Larkin promised Hauge to support the application if it was possible within the terms of reference for the MWDP. The difficulty was that the MWDP supported only the development, not the production, of new weapons and equipment. Hauge concluded in his report after the meeting that although the MWDT was in favour of supporting the production «It is not possible to say how far he (Larkin ed.) can go. Under all circumstances the decision must be taken in Washington.»<sup>49</sup> Hauge's report after the meeting gives the impression that the NDRE took the initiative and that MWDT did not know about the application which was being prepared. At the same time we know that American support was one of the conditions for contracting work the

month before. The most likely explanation is that the Americans had vaguely promised to pay for parts of the production. The NDRE therefore immediately initiated the contracting work and began to raise money.

General Larkin came to Norway in the beginning of February. The report after the meeting illustrates how the MWDT and the NDRE cooperated in the process of preparing the application. We «wish to find a pattern for the project which enables the Americans to pay for the making of three complete weapons that can be used in trials,» Lied wrote.<sup>50</sup> Lied emphasized that it was important to give the impression that Norway would cover as much as possible of the production costs. The MWDT «accepts, however, that we should include the Navy's total expenses for the installation and the running of the ships during trials.» Lied also wrote that the MWDT should go through a draft of the application before it was finally written.

In the final application the NDRE stressed the fact that the Terne weapons were to be produced for «engineering and preliminary evaluation tests.» The trials had revealed the necessity for «pre-production models.» The NDRE argued that only when these models were finished would it be possible to furnish the test data which was required for the NATO authorities assessing the system. The Establishment applied for USD 2.325 million from the U.S. In the application it was also estimated that with U.S. aid the Terne weapon would be installed and ready for use in 1962; without U.S. backing it would be installed in 1965.<sup>51</sup>

The NDRE director, Lied, went to Paris in person with the application. According to him, the MWDT was very pleased; «You have put forward a good case and we will act upon it,» Larkin said.<sup>52</sup> Within a week the proposal was sent to Washington. More than six months later - in November 1958 - the NDRE sent a revised application to the MWDT. It is likely that this revised proposal was necessary for formal reasons. The U.S. Government reacted promptly and within a month the Norwegian Government was presented with a contract.<sup>53</sup>

Finn Lied wrote in a resumé of the contract that the American contribution «could only be characterized as generous.»<sup>54</sup> In brief the contract implied that «the U.S. would pay for the production of the systems, while the Norwegian contribution would be covering the costs of the installation.»<sup>55</sup> In addition a portion of the Navy's expenses for the running of three vessels, and wages to a group of technicians and researchers at the NDRE, were included as part of the Norwegian contribution. These contributions «will not require any outlays exceeding the normal budgets, and

they were included so to say in accordance with the MWDP to show a reasonable sharing of the expenses between the two countries,» Lied wrote.<sup>56</sup> The contract was sanctioned by the Storting in the beginning of 1959.<sup>57</sup>

## **The U.S. contributed with more than money**

Looking back at the MWDP program in 1963, Fredrik Møller wrote that financial support made it possible to complete the projects earlier than would otherwise have been the case. However, he went on, «what is more important is that the researchers at the NDRE through this support have had the feeling (...) that a superpower appreciates the results of their research and regards them as significant. This fact has probably also influenced our authorities and the armed forces.»<sup>58</sup>

Beyond doubt, American financial support was essential when the Terne project started. It must have been a relief for the researchers at the NDRE not to rely on a sceptical Norwegian Navy. Traditionally, the Norwegian military had relied upon advice and help from colleagues in Great Britain. Most of the researchers at the NDRE had been in Britain during the war. Consequently, when the Terne project was outlined, it was emphasized that cooperation with allies was important for its development. But the Admiralty was not interested in the Terne project in 1954, and the NDRE did not know where to seek support. Thorvald Gerhardsen asked for American professional support in July 1954, but his letter seemed to imply uncertainty about the American willingness to help; «Our information on available U.S. reports and equipment is very limited and consequently we do not know specifically what to ask for. In case anything can be made available to us we should like to list the subjects of most interest. Reports, handbooks, instructional manuals or any other information covering these items will be studied with great interest.» Gerhardsen then listed eleven technical fields of particular interest and he concluded the letter: «It is understood that the latest developments in some of these fields may be highly classified, thus preventing any exchange of information.»<sup>59</sup>

Professional American assistance turned out to be more than originally asked for. In February 1955 three American experts participated in a three-day conference on the Terne project.<sup>60</sup> One of the conditions for the MWDP support was also that the NDRE should prepare reports on the project every third or sixth month. These reports were studied by American experts and the NDRE knew that the project was being assessed by qualified people outside the country.

One aspect was professional support in the development of Terne; even more important, however, were the efforts on the part of the U.S. to promote the sale of the Norwegian weapons system. The MWDT proposed in September 1956 that Norway should be «very liberal» when it came to publishing information about the Terne system. MWDT argued that this would make it easier for the Norwegians to sell the weapon. A year later, the U.S. asked for a presentation of the Terne system in NATO's Defence Production Committee.<sup>61</sup> At the same time the Americans were themselves considering buying the Norwegian weapon. «The U.S. Navy Bureau of Ordnance has unofficially expressed considerable interest in the TERNE system, for possible application to small U.S. Navy A/S type ships,» Admiral M. R. Kelley wrote in May 1957.<sup>62</sup>

It is also worth mentioning that the U.S., both through the MWDT and in particular through the MAAG (the military advisers at the NATO embassies), had an important influence on weapon procurement in the NATO countries. For example when the MWDT asked the Norwegian Minister of Defence to inform West Germany about Terne, Larkin in the MWDT wrote: «This office has received information through the U.S. Military Assistance Advisory Group to the Federal Republic of Germany that the German Navy is presently entering into the design stage of its construction program. Considerable thought is being directed toward the procurement and installation of the latest weapons and equipment possible.»<sup>63</sup>

The U.S. was the driving force in the selling of the system and the NDRE was, at this stage, much more reluctant to promote the system abroad. Norwegian researchers did not want to start selling the system until the work of development was totally finished. «A continuous stream of representatives from allied nations now, will impede the progress of our work. Our attitude is that we must now finish the system and do the trials by ourselves. Once this has been done, we will invite all the nations interested and give them all the information they need for the assesment of the weapon,» the NDRE wrote in September 1956.<sup>64</sup>

## **Terne and Kongsberg Våpenfabrikk**

KV was not a «natural» choice as production site for the Terne weapon. «The plant (...) was strongly affected by the circumstances of the community itself – a comparatively small community, somewhat isolated geographically from other areas, with a population consisting mostly of families who had lived in the community for generations.»

The American analysts in the company Yulke were not impressed when, in 1953, they examined the possibilities for rationalizing the production at KV. They described a company with solid traditions of craftsmanship, but with practically no industrial capability.<sup>65</sup> The company, which was part of the Army until 1947, had mainly produced rifles (Krag-Jørgensen), tools and harpoons.

Nevertheless, looking at the decision-making process at the NDRE, the impression one gets is that KV was the only real alternative. In the beginning of 1956, the steering committee for the Terne project agreed to establish contact on an informal basis, in order to explore the issue of production.<sup>66</sup> The director of KV at that time, Bjarne Hurlen, remembers that the first contact was made in 1955 and that the initiative came from the NDRE.<sup>67</sup> The NDRE urged KV to make a decision on the production issue in March 1956 «as we regard it as important that the producer is included in the process as early as possible.»<sup>68</sup> The NDRE wanted KV to be the main contractor. There are no traces to be found of a debate inside the NDRE before KV was contacted.

## **KV and Norwegian military industry before Terne**

After the Second World War, spokesmen for the major political parties wanted to build up a Norwegian military industry. They did not, however, allocate any money to such a project. The need to rebuild society outweighed the need for new weapons in the early postwar years. The Ministry of Defence, several times in the early fifties, advised KV to base its activity on civilian products.<sup>69</sup> Bjarne Hurlen today says that most of the

products at that time were so old that the patent rights were outdated.<sup>70</sup>

The Storting finally fulfilled some of its promises by granting NOK 25 million to the modernization of KV in 1953. In the proposal from the Ministry of Industry the importance of Kongsberg Våpenfabrikk as a «cornerstone for the military production» was stressed.<sup>71</sup> The ministry wanted to upgrade the defence sector of the economy partly in order to ensure that maintenance requirements were met. Moreover, the supply of spare parts would also be guaranteed by strengthening the indigenous military-industrial base.

In 1955 the company started the production of a light anti-aircraft gun on license from the Swedish company Bofors. The L/70 cannon required the construction of new production lines at KV and, as Olav Wicken writes, the project provided a basis for the future growth of Norwegian military industry.<sup>72</sup> The L/70 production also enabled KV to benefit from the American «Off-Shore Procurement» program. That is, the U.S. paid companies in Europe for the production of weapons intended for the military in European countries. In 1957 and 1958, the off-shore sale represented half of the total sales from KV.<sup>73</sup>

Political support for weapon production at KV pretty soon faded away. The weapon industry was less important than other civilian sectors of the economy during the postwar period. When politicians were forced to choose between industries, their priorities were clear. In the Annual Report from 1956 the Board of KV expressed the need to enlarge civilian production «because of a strong reduction in the purchases from the Ministry of Defence and uncertainty about the coming needs.»<sup>74</sup> The Ministry of Defence also formally informed KV that the company «in the coming years cannot count on any major contracts with the Norwegian armed forces.»<sup>75</sup> As a consequence, the board of KV allocated NOK 12 to 13 million in order to upgrade civilian production in 1958.<sup>76</sup>

## **KV's capacity**

«Looking at the system as a whole, there were only tiny parts of the production that would fit into KV today. This is so not only for the electronical equipment, but also for the mechanical components,» Knut Seim and R. Lie Andersen (engineers in charge of the newly established R&D department at KV) wrote in February 1956.<sup>77</sup> Finding it hard to



estimate precisely how much of the work that could be done with the existing machinery at KV, they made a guess of less than 10 per cent. «The remaining 90 per cent consists of purchased ready-made electrical components that have to be built into bigger entities. This work and the production of special parts must be done by subcontractors.»<sup>78</sup>

Lie Andersen and Seim also wrote that the Terne project was totally different from the present production of KV. Nevertheless, they mentioned five reasons for a more thorough examination of the project.

- 1) Terne will be an original product, enabling KV to act as more than just a subcontractor.
- 2) Assuming that demand is forthcoming, the volume of production would be considerable.
- 3) Because of the size of the project, it would be possible to pay for relatively large investments in equipment and manpower.
- 4) It is a military project.
- 5) There is an increasing tendency in the industry to apply servomechanism and electrical equipment instead of purely mechanical equipment.

A further examination would also provide the company with «valuable information as to whether KV should direct its efforts towards products in which an appreciable part of the product is made up of servomechanical and electrical equipment,» Lie Andersen and Seim wrote.

The examination was not pursued in detail. Six months after these deliberations at KV, the NDRE complained about lack of interest from the company. The researcher in charge of the NDRE department at Horten, Henrik Nødtvedt, wrote that the two visits to Horten and Kjeller «have not been followed up actively and it is now desirable that some of the personnel concentrate on Terne, if we want to avoid delays in production.»<sup>79</sup>

This letter from Nødtvedt provoked another report from Seim at KV. And this time no consideration was taken of the benefits and drawbacks of the Terne project. It seemed as if it had already been decided that KV should be the main contractor for the Terne project.<sup>80</sup> At this moment it was more important for KV to discuss the financial aspects of the contract. KV proposed to the NDRE «a kind of research and development contract».<sup>81</sup> Fredrik Møller and the steering committee of the Terne project rejected such a contract because they wanted a maximum price and fixed terms of deliveries. The NDRE told KV officials that they would contact other companies if KV did not accept this type of contract.<sup>82</sup>

KV accepted, it would appear, without much internal discussion. The KV leadership discussed the Terne contract on 4 December, 1957. They reckoned that the weapons system would cost approximately NOK 5 million. «It is therefore a considerable financial risk for KV, and therefore the project must be managed within definite limits.»<sup>83</sup> This is how it was expressed in the report from the R&D department at KV. At this time, the company planned to let subcontractors do 40 per cent of the work. At KV the project necessitated the employment of ten people.

It is difficult to assess the economics of the Terne project today. KV used much more money and manpower on the project than originally envisaged, and lack of experience obviously contributed to misleading estimates about the costs of the project. Even more important from an economic point of view was the question of income resulting from the sale of the system. When Bjarne Hurlen informed the Board of KV about the Terne project, he predicted «a considerable sale». He based his predictions on statements from the NDRE and «foreign naval authorities.»<sup>84</sup> Kristian Søgne in the R&D department wrote at about the same time that the price of the weapon was of little importance as «one is today relatively alone on the market.»<sup>85</sup>

The market for Terne turned out to be a Norwegian market. The Terne weapon was lighter than all other existing anti-submarine weapons in the fifties. The problem with the weapon, however, was that it did not work over long distances. The range of the missiles was too short. It should also be said that the market for anti-submarine weapons changed in the late fifties and the early sixties. Sweden and Holland cooperated in the development of a new anti-submarine weapons system and France developed its own system. In 1957 and 1958, when interest in Terne was at its peak, the French and Dutch-Swedish researchers had not reached the same stage as the Norwegians. In the Spring of 1957 the NDRE had received so many requests from abroad that they made a brochure for the Terne system. The NDRE sent the «Brief Description of Terne A/S Installation» to the MWDT, yet at the same time they complained about the interest from abroad: «We point out that the information submitted has been kept short and to the point in order to avoid instigating work on a report the usefulness of which will be questionable when the final report is finished. This again is of course dictated by a reluctance to start writing reports which will give the personnel engaged on Terne III an extra load of work, however little.»<sup>86</sup>

Against this background it is reasonable to assume that the NDRE gave

KV the impression that it was easy to sell Terne abroad. The prospects for sales were good, but these prospects in themselves do not appear to have been important when KV decided to produce the Terne system. As already mentioned, the decision was taken before the end of October 1957. Hurlen's information to the Board on the Terne project six months later was technical and there were few considerations of costs and sales in it.

The only discussion to be found in the files of KV today is the report Seim and Lie-Andersen wrote in February 1956. Hurlen today says that it was «in fact Møller, Hauge and I who took the decision.»<sup>87</sup> Jens Christian Hauge was the deputy chairman of the Board at KV - the chairman delegated most of his responsibility to Hauge. Hurlen says that Møller and Hauge were the active ones - he was the passive party. The Terne project was not exactly what KV was looking for. «We needed the earnings fast and consequently we tried to obtain license production,» says Hurlen.

As soon as the production of Terne started at KV, Hurlen naturally began to argue in favour of the project. But it is likely that Hurlen is right in giving the impression of reluctance towards the project at Kongsberg. When KV got the L/70 contract, the company had expressed a great deal of scepticism about the project.<sup>88</sup> When Hurlen informed the members of the Board he also stressed several drawbacks of the Terne production.

## **Why did the NDRE pick KV as main contractor?**

«You have a military research establishment and you have a military company - it's natural that they cooperate.» Willy Simonsen, the founder of the sonar producer company SIMRAD, gives voice to the most natural explanation. It might be true. KV's reputation was poor<sup>89</sup> and the capabilities of the company did not fit the requirements of the Terne project. Moreover, the administration at KV did not work actively to secure the Terne contract. But the alternatives to KV were not very much better.

The Norwegian society of the fifties has been described as semi-industrialized, the reason being that exports consisted mainly of raw materials and semi-finished products and only to a limited extent of manufactured goods. It was the energy and capital intensive electrochemical and electrometallurgical industries which were given priority after World

War II. Machines in other parts of industry were not renewed. Professor D.P. Campbell of Massachusetts Institute of Technology (MIT) wrote, with the Norwegians Håkon Buset and Haakon Sandvold, a report on the state of the metallurgical industry and the engineering industries. The conclusion was not encouraging: Norwegian industry does not operate with «the accuracy required for the production of gears and components used by the military, or more modern highly developed types of mechanical, hydraulic and electrical equipment for control.»<sup>90</sup>

Because of U.S. financial support and for security reasons, the option of allowing foreign companies to produce the Terne system was never discussed.

The assumption is that the NDRE, because of low industrial standards in Norway, understood that they had to follow the production closely wherever it was. The NDRE expected the contractor to send his employees to the NDRE laboratories for a period of time. The Establishment also planned to send their own employees to the company chosen, in order to follow the production of Terne. The question therefore is not whether the company chosen had the capacity to produce Terne. The question is rather which company was the natural choice for the NDRE.

Traditionally there were other companies with closer contact to the NDRE than KV. The NDRE department for sonars and submarine-fighting in Horten was in charge of major parts of the Terne project and this department had contact with several companies in the town of Horten itself. The Navy yard was here and the only commercial sonar company, SIMRAD, was based in Horten. The first leader of the Terne project, Thorvald Gerhardsen, worked in SIMRAD, and the first sonars for fishing vessels made by the company were originally developed at the NDRE.

The NDRE also tried to include SIMRAD in the Terne project. It was obviously important to let SIMRAD produce the sonars in the weapons system. This is illustrated by the fact that the NDRE wanted both SIMRAD and KV as main contractors. Ideally, KV should be the main contractor, but SIMRAD would not have the status of subcontractor for KV. The NDRE wanted to sign a special contract with SIMRAD. The director of KV, Bjarne Hurlen, protested several times against this arrangement, without much effect. Informing the Board at KV, Hurlen said that «SIMRAD perhaps doesn't fully believe that KV has the capabilities required for the production of the system.»<sup>91</sup>

SIMRAD was regarded as a more qualified company than KV, but perhaps in a narrower field. The researcher in charge of the electronics

(then named Telecommunication) department at the NDRE, Karl Holberg, also regarded SIMRAD as better qualified to sell the Terne system than KV.<sup>92</sup> It should also be said that the founder of SIMRAD, Willy Simonsen, was a good friend of Fredrik Møller. Simonsen had done research for the allies in England, together with the men who founded the NDRE.

The negotiations between SIMRAD and the NDRE broke down for different reasons and the result was that KV became the sole main contractor. A consequence of the failure of negotiations was that SIMRAD withdrew totally from the project. My point here is that SIMRAD in cooperation with the Navy yard and some other mechanical shops in Horten, must have been a more natural choice than Kongsberg Våpenfabrikk.

In Oslo and Strømmen, close to Kjeller, there were also some companies with closer historical ties to the NDRE than KV. Strømmen Verksted was one of the first companies in Norway to show an interest in servomechanical production. Standard Telefon og Kabelfabrikk (STK) (then an affiliate of ITT) was also mentioned as «progressive» in a letter about servomechanical industry written by the NDRE researcher Erik Klippenberg in 1953.<sup>93</sup> In 1957 STK tried to start servotechnical production in cooperation with the Christian Michelsen Institute in Bergen.

NEBB (Norsk Elektrisk & Brown Boverii, Oslo) was once asked by the NDRE to produce servo equipment components, but the company declined.<sup>94</sup> I do not know why NEBB refused, but it shows that there must have been some potential for Terne production at NEBB also. In Oslo there were several mechanical companies with facilities comparable to those of KV.

KV was not the only military company in Norway. Raufoss Ammunisjonsfabrikk (RA) was bigger and more important in the fifties than KV.<sup>95</sup> RA had modernized more than KV in the fifties, but their knowledge was confined to a narrow field - ammunition and rockets. The management at RA was not particularly good. «It's a pity, the conditions at RA, but with lack of initiative, enterprise and energy, one will not have results at RA, and RA cannot expect others to do the work for them,» one of the managers of KV wrote in 1960.<sup>96</sup>

Asking Finn Lied today why the NDRE picked KV as main contractor, he says that Bjarne Hurlen was an «outstanding leader with a solid military education.» This does not fit very well with the lack of interest which KV showed in the early phase. Our search for explanations may be

rewarded if we look at some of the personalities involved. Bjarne Hurlen says that it was Møller and Hauge who urged KV to accept the Terne contract. It is also likely that Møller and Hauge had a decisive word when the NDRE picked KV as main contractor. Møller was director at the NDRE and was formally responsible for the decision. Hauge was the deputy chairman of the Board for the military companies (KV, RA and the Navy yard at Horten). A closer look at Hauge's background is required in order to appreciate his position of influence.

Jens Christian Hauge was the leader of Milorg (the resistance movement) during the latter part of the Second World War. He was private secretary to the Prime Minister until he was appointed Minister of Defence. He resigned from the Cabinet in the early part of 1952 and started working for the Labour Party – playing an important role in the making of the 1953 party program. He was looked upon as one of the closest advisers of Prime Minister Einar Gerhardsen in the postwar period. «The never-sleeping conscience and critics on a broad range of political issues,» the party secretary Haakon Lie wrote.<sup>97</sup> Gerhardsen himself wrote that Hauge had «a decisive influence» in the discussions about a Nordic alliance as opposed to NATO.<sup>98</sup> The Swedish Prime Minister Tage Erlander wrote in his memoirs about the negotiations on Nordic cooperation that «it was a big surprise in Karlstad that the Norwegian delegation was so totally dominated by Hauge.»<sup>99</sup> Hauge was also considered a stubborn and not very cooperative man. He was in serious conflict with several Chiefs of Defence. Inside the Cabinet he was in conflict with the Minister of Finance, Olav Meisdalshagen. Another leading politician at that time, Olav Oksvik, said that the conflicts between Meisdalshagen and Hauge was one of the reasons why Gerhardsen resigned in 1951.<sup>100</sup> The Minister of Foreign Affairs, Halvard Lange was also opposed to including Hauge in the Cabinet in 1955 because of Hauge's tendency to concern himself with issues outside his own department.<sup>101</sup>

Jens Christian Hauge worked as a legal adviser at the NATO headquarters in Paris in 1957-58.<sup>102</sup> The Norwegian Government asked for his advice several times, and asked him to participate in several international negotiations as the Norwegian representative.

At KV, Hauge was closely involved in the discussions that led to the production of L/70.<sup>103</sup> He was used as legal adviser and as a mediator between American and Norwegian authorities. He had also granted money to the NDRE in the early years. «Destiny has been good, or Gerhardsen has been helpful by making Hauge Minister of Defence,»

Randers wrote.<sup>104</sup> It is a fact that the NDRE got more money than most of the other research institutions in Norway at that time.

«Møller and Hauge talked with each other every day,» Hurlen says today. Documents from that time indirectly support the argument that Møller and Hauge decided by themselves that KV should be the main contractor for the Terne systems. As stated above there are no minutes from discussions in the files of the KV or the NDRE relating to the choice of KV as the main contractor. Of course, there was no need to put it in writing since the matter was decided orally by two good friends.

## **Why did Møller and Hauge pick KV?**

Hauge was obviously concerned about KV's future. As from 1948 he had been working for the modernization of KV. After assessing the documents, it seems that Hauge was never forced to defend his position. The assumption is simply that he wanted a strong military company both for strategic military reasons and for economic reasons. He wanted a company in Norway that could produce and maintain the modern equipment of the Military. It is likely that Hurlen used some of the same arguments as Hauge when he informed the members of the board about the Terne project. His presentation of the project focused on its importance for the development of the military production lines. He said little about the wider perspectives: the Terne production would qualify the company for servo technical production which in turn would qualify the company for the advanced processing of all kinds of civilian products.

Shortly after the Terne decision was made, Fredrik Møller showed, in practice, that he wanted to encourage civilian spinoffs from the research done at the NDRE. He became the first director of Noratom, a company set up for the commercial utilization of patents and for the ideas originated in research institutes.<sup>105</sup> This company was created mainly for the application of work from the civilian institutes, but it shows that Møller was concerned about the R&D-based industry. The reason why Møller preferred KV from the very beginning can be traced to the fact that he distinguished sharply between military and non-military products. In the

concluding chapter, I will argue that Møller in a way was caught by the system. The NDRE grew more and more military-like and it became more and more difficult to think about non-military producers of a military product.

## **The production at KV**

The contract between the NDRE and KV was signed in January 1959. KV offered a fixed price (NOK 16.020.000) for the three systems and the delivery date was fixed for two years later.<sup>106</sup> It started off fairly well. «Kongsberg Våpenfabrikk has made impressive efforts and the cooperation between all parties involved has been outstanding.» Finn Lied informed the Ministry of Defence in September 1959.<sup>107</sup> KV also asked for advanced payment as the «progression of the Terne systems is faster than settled in the contract.»<sup>108</sup> Even so, the people in charge of the production, the R&D department of KV, complained that the work was not proceeding as fast as it ought to. According to the internal plan, the production was delayed from 14 days to one month during most of 1959. At the end of that year, the US Procurement Office ordered two Terne systems; and these new orders contributed to longer delays in 1960 and 1961. The delivery of systems number four and five were seriously delayed. The electrical control equipment, the launcher and parts of the loading-mechanisms caused the longest delays.<sup>109</sup>

The delays provoked harsh reactions: «State-owned companies clearly don't take dates of delivery very seriously,» remarked Thorleif Pettersen, the leader of the Technical Department at the Navy Headquarters.<sup>110</sup> The council of the NDRE which consisted of the Joint Chiefs of Staff, civilian researchers and the department heads at the NDRE, discussed the delays at the end of October. They decided that the NDRE should intensify its efforts to help KV as the company had problems, «particularly concerning the quality of the work».<sup>111</sup>

Finn Lied pointed out that the sonars and the fuses of the Terne system were the main bottlenecks of production.<sup>112</sup> The R&D department also cited the fuses as a main problem. Generally speaking KV felt that much of the problem was due to the poor quality of the blueprints and construction drawings from the NDRE.<sup>113</sup> However, the NDRE and to a certain extent the Navy felt that the lack of competence at KV was the main cause for the delays.



## Changes of the prototype

The Terne weapons on board Norwegian vessels today are distinctly different from the prototype. The first trials in Key West in the fall of 1958 uncovered 62 substantial changes that had to be made. During the winter of 1960 the steering committee of the Terne project discussed three of the most profound proposals for change: 1) a longer-range missile, 2) transistorizing of the computers and 3) new scanning sonar.<sup>114</sup> Most of the proposals were acted upon, and the changes were so basic that it became impossible to use the prototype for practice at the Navy school as originally planned.<sup>115</sup>

The changes were discussed in the Navy, at the NDRE and at Kongsberg. This fact illuminates the close ties between these institutions. The NDRE and KV grew closer. Many of the people working with the Terne project at the NDRE continued with the project at KV. Some of the engineers at KV worked for nearly one year at the NDRE to gain knowledge of the project. In a way, the NDRE served as the research and development department for KV and KV functioned as the workshop for the NDRE. To complicate relations even more, the NDRE was also the formal buyer of the three first Terne systems. It was the MWDP which granted money to the NDRE enabling them to order the weapons. In the Navy both the NDRE and KV were regarded as the producers of the systems. These vague relations contributed to a promotion of the Terne weapons abroad that must have been confusing.

## The sale of Terne

KV has produced 14 Terne systems in all. The U.S. bought two systems and then returned them to Norway. West Germany also bought two systems. The remaining ten systems were bought by the Norwegian Navy. This figure includes the first three that were paid for by the MWDP. The sales effort abroad can be divided into two stages. In the beginning the NDRE promoted Terne within NATO. During this period the Navy officers and the procurement offices in different NATO countries were involved. In 1960 when the Norwegian government decided to modernize the Navy and buy vessels and equipment at the sum of NOK 840 million, the sales approach to Terne changed. The modernization plan required large purchases from abroad. However, contracts with foreign companies made it possible to force foreign countries to buy Norwegian products, in a kind of barter trade. One example is the agreement with West Germany regarding the purchase of 15 submarines at the price of NOK 260 million. West Germany pledged to buy Norwegian equipment for approximately NOK 430 million.<sup>116</sup> It is evident that the sale of Terne to West Germany was a political as well as a Naval/Military issue.

In discussing the likely income for KV, I showed that there was already a keen interest in the Terne weapon in 1957. The NDRE was reluctant to spend time and money on sales at such an early stage. At the end of 1957, the NDRE was persuaded by the MWDP and the Norwegian Military Attaché in Bonn to demonstrate the system for West German Naval officers.<sup>117</sup> Less than a month after the system was presented, the steering committee of the Terne project decided to start working on selling the system. «The Brief Description of Terne» that had been sent to the West Germans was replaced by a sales brochure. Bjarne Hurlen stressed the advantages of personal acquaintances; we will circulate information about the system «through the representatives of the Ministry of Defence, the Military Attachés, as was done in Bonn,» Hurlen said.<sup>118</sup>

In the spring of 1958 the NDRE presented the Terne weapon to representatives from all the interested NATO countries. The NDRE wrote afterwards that the demonstration was «successful, although there were some minor accidents.»<sup>119</sup> The accidents consisted of the sonars being non-operational; however, the other parts of the system worked. At the end of that year SACLANT wanted to present technical facts about the weapon in a seminar about anti-submarine fighting.<sup>120</sup> However, after the

trials at Key West in the fall of 1958, the report was delayed and Terne was not presented at the seminar.

At another NATO meeting in Paris in May 1959 Terne was presented. The most optimistic Norwegians expected that NATO would agree to a coordinated production program of the Terne systems for all NATO countries. The Ministry of Defence sent this telegram to the representative in Paris, Nils Sæbø:

1. «If there should be a need for Terne inside NATO which exceeds the production capacity in Norway, the Norwegian Government will want to discuss the possibilities of a coordinated NATO production program for the equipment.
2. The development costs for the system will not be included in the price of systems sent to other countries.»<sup>121</sup>

The optimism was based on the keen interest expressed by many countries. For example, the first promotion of Terne in the U.S. went smoothly without problems. The Norwegian delegation sent there in August 1959 found that although the Americans did not have much knowledge of Terne, they showed great interest and belief in the Norwegian weapons system. In September 1959 Vice Admiral John Hayward said that Terne was the best existing anti-submarine weapon when he confirmed that the U.S. Navy wanted to buy it.<sup>122</sup> It was Admiral Colwell in the MWDT who informed the NDRE about the American decision to buy three Terne systems.

It is hard to trace any active effort on the part of the Norwegians to sell the system to the U.S. Navy. On the contrary, Henrik Nødtvedt at the NDRE complained that the Norwegian Navy had acted against the interests of the people selling Terne. «My impression is that the Navy, during their stay in the U.S., has been so keen on saving money on their existing vessels» that the Americans thought they were being helpful when they offered to take over the Terne contracts originally made by the NDRE.<sup>123</sup> In other words, the Navy wanted to let the U.S. Navy take care of the trials of the Terne weapons which were paid for by the NDRE. The different points of view of the Norwegian Navy and the NDRE did not make a big difference as far as the sale to the U.S. was concerned. Selling to West Germany, however, was an uphill battle, and the disagreements between the researchers and the officers became more profound.

The promotion of Terne in West Germany was seen as essential. «If Germany decides to buy the Swedish-Dutch system, it might be of vital

importance for the attitudes of other NATO countries (...). On the other hand, if we manage to introduce Terne in West Germany, we may also reckon on considerable orders from other NATO countries. Contracts to a value of between NOK 50 and NOK 100 million are not unrealistic.»<sup>124</sup> The Chief of KV's Oslo office, Yngvar Daasnes, did not exaggerate the importance of West German deliveries when he made the above statement in a letter to the Ministry of Defence. To judge the sales effort it is therefore necessary to study the promotion of Terne in West Germany.

The first contact between the West German Navy and the NDRE was made at the end of 1957. During most of 1958 and 1959 a representative of KV in Bonn managed most of the selling of the Terne. It was a big surprise in April 1959 when the commercial attaché in Bonn, was notified that the West German Navy had decided to buy the Swedish-Dutch system equipped with French sonar parts. The commercial attaché asked the West Germans to postpone the decision. The Ministry of Defence in Oslo decided to ask the Chief of the Navy to urge his West German counterpart to change his mind.<sup>125</sup>

The Norwegian efforts did not help. West German officers mentioned two main reasons for not buying Terne: the range was too short,<sup>126</sup> and the possibilities for logistics and training were better in the system which was made in Holland and France.<sup>127</sup> Although the main purchase of anti-submarine weapons for the West German Navy was already decided, there were still possibilities for less sizeable purchases – one of which was the installation of Terne in patrol vessels.

The installation of Terne in patrol craft vessels and in fishing vessels for use when mobilized was the aim when the promotion was politicized in 1960. The Norwegian Ministry of Defence told its West German counterpart that Terne was one of the items West Germany ought to buy in response to the Norwegian purchase of submarines from West Germany. The West German representative in the negotiations said that «there were some doubts about the Terne system, but that a West German technical commission was prepared to come to Norway in the near future for a thorough examination of the project with Norwegian experts.»<sup>128</sup> This meeting was convened on 21 April and ended on 23 April 1960.

The meeting encouraged both the NDRE and KV. «I believe that we have convinced the German delegation that Terne is not a toy put together by a little country, but an anti-submarine weapon that ought to be the subject of serious deliberations,» Lied wrote after the meeting.<sup>129</sup> An even more optimistic comment is found in a report written by KV's Knut Seim

at the end of May. He reported that Captain Meuseman in the West German Ministry of Defence had proposed that «the Navy should examine the possibilities of installing Terne weapons on ten patrol craft vessels which had not yet been constructed. Meuseman also aired the possibility of putting the Terne systems onboard auxiliary vessels».<sup>130</sup>

The West German Government ordered two Terne systems at the end of 1961, one of the systems was not equipped with sonar as the Germans wanted to use a Dutch sonar.<sup>131</sup> The Navy wanted to test these systems for a period of two years and KV expected to sell more to West Germany after these tests were completed. Commander Jens Sele described West German officers as regretting that they had not bought Terne when they had the opportunity in 1958.<sup>132</sup> In spite of all the good will, the West Germans never bought any more Terne systems.

Summarizing the attempts to sell to West Germany in 1965, Finn Lied wrote that the sale of the two Terne systems was a consequence of pressure from the West German Ministry of Defence, «as the German Navy has been hesitating.»<sup>133</sup> Lied wrote that this hesitation was a result of lack of experience inside the West German Navy. «They were compelled to seek support wherever they could find it. The Dutch Navy at an early stage offered assistance in the training of West German anti-submarine personnel. (...) When the West German Navy was to buy the first anti-submarine weapons it was natural that the Dutch were consulted and that their advice weighed heavily.»<sup>134</sup> Lied at the same time proposed that Norway should help in training West German Navy officers. This proposal was never acted upon.

The fruitless sale effort also explained as a matter of politics. «It's evident that it's wholly a matter of political means. Our items, too, must be promoted with a blend of political pressure. If not, the political pressure of others will decide.» Finn Lied wrote in a general report on the sale of Norwegian military equipment.<sup>135</sup> There is no doubt that the politicians and the officers in Norway were hesitant when the NDRE and KV asked for help in selling Terne. As late as in 1966 the deputy Chief of the Navy reacted negatively when the Navy was asked to promote the weapons system in Denmark. «The Chief of the Navy should not be a «glorified salesman!»» was his remark.<sup>136</sup>

Next, I will examine the sales promotion in order to illuminate how the different institutions managed to blend the commercial, professional and political aspects of the work.

The Ministry of Defence reluctantly became an important performer in

the sales promotion. In April 1958 the NDRE wanted the Minister of Defence to promote Terne at a NATO meeting. That was the first time the Minister was asked to promote Norwegian commercial interests. It is unclear what he actually did at this meeting of NATO Ministers of Defence. In general, the Norwegian Ministry of Defence was unwilling to become involved in these matters. R. J. Mowill, who worked with KV, complained in December 1958 that the Ministry had not informed KV about the possibilities for coproduction of the Sidewinder rocket. Because of the Ministry of Defence, Mowill wrote: «Norway is falling behind (...) totally by failing to keep informed about the weapon cooperation inside NATO.»<sup>137</sup>

Six months later, when West Germany decided not to buy Terne, the Ministry of Defence discussed thoroughly the possibilities for promoting the weapons system. The Head of the procurement office, Johan K. Christie, gave this brief of the deliberations: «It's, of course, difficult for Norwegian officials to act more or less as salesmen for Norwegian companies, even if these are state-owned. On the other hand, there are no doubts that we are now strongly in favour of all efforts that can lead to increased employment, and it's partly for this reason that the politicians are now willing to go considerably further than they would otherwise have done when it comes to official Norwegian initiatives.»<sup>138</sup>

It took some time for attitudes to change. In August 1959 the Minister of Defence refused to send a promotion letter to the Government in Spain.<sup>139</sup> However, when the agreement on the purchase of submarines from West Germany was made, the Ministry of Defence became active sellers of Terne. Finn Lied wrote that the Minister of Defence had mentioned the sale of Terne as «extremely important» when he informed the Military Committee of the Storting. The main purpose of his visit to West Germany was to contribute to such a sale, Lied wrote.<sup>140</sup> It would appear that the Minister of Defence in many ways adopted the arguments of the NDRE. The Terne project was presented as one of the two sole independent Norwegian projects, the other was the Norwegian built vessel Nasty. «The sale of Terne to West Germany will give Norwegian companies a technical position and it will greatly contribute to the laying of a platform for technologically advanced products in the Norwegian industry,» Finn Lied wrote.<sup>141</sup>

The director of the NDRE looks today on the Terne project as the one which contributed to changes in the attitudes of the Ministry of Defence and the Navy. «The lower ranking officials in the Navy and the Ministry

felt in the beginning a moral obligation not to sell Norwegian products, while at the same time colleagues in other countries had a different attitude and worked hard in promoting the products of their countries. After Terne the Norwegian attitude changed dramatically.» Lied says.<sup>142</sup>

The NDRE and KV blamed the Navy for the first failure of the sales promotion in West Germany. Informing the Ministry of Defence about the West German decision not to buy Terne, Yngvar Daasnes mentioned two facts that had been vital for the Germans: 1) They had not received an official report after the trials of Terne in Key West, and 2) they had the impression that the Norwegian Navy was not wholeheartedly supporting the system. «Regierungsbaudirektor Schüler drew our attention to the fact that neither the Norwegian Navy nor the Norwegian authorities had backed KV in the Terne case, except for the fact that the Military Attaché in Bonn on a couple of occasions had accompanied the representatives of KV when visiting the Verteidigungsministerium. (...) the Dutch Navy had taken an entirely different attitude (...) High-ranking Dutch officers had contacted their German colleagues in such matters,» Daasnes wrote.<sup>143</sup> This reiteration of the West German points of view was repeated in another letter from the commercial attaché in Bonn, Gunnar Rogstad.<sup>144</sup> He and Daasnes both asked the Ministry of Defence to contact the Navy and persuade them to contact the Germans. Whether it was this request which prompted the Navy to act, I do not know. The Chief of the Navy met his West German counterpart in April that year and in the beginning of June he sent a letter offering a full and proper briefing about Terne by technical experts in the Navy. The Chief of the Navy, Vice Admiral Johs E. Jacobsen, referred to the fact that the U.S. Navy wanted to buy several systems and he wrote that the weapon worked efficiently. No further compliments were paid to the Norwegian-developed weapon in the letter.<sup>145</sup>

The Navy was vital for sales promotion because it was responsible for the operative tests of Terne. Navy officers were consequently included in all delegations presenting the system. The NDRE found that Navy participation sometimes damaged the sale effort. At a meeting with the West Germans in Horten, the Navy representatives started discussing alternative positions for the sonars on the vessels. The information used did not correspond with information given by the NDRE and both Erik Klippenberg and Karl Holberg at NDRE reacted spontaneously: «The Navy and the NDRE should at least present a similar view to the outside world. What's been done in this case must have confused the Germans,»

Klippenberg wrote. «It's talk like that which damages our commercial opportunities,» Holberg wrote.<sup>146</sup>

As late as the summer of 1962, it would seem that the leadership of the Navy was indifferent to the sales promotion. Bjarne Hurlen asked the Chief of the Navy, Admiral Erling G. Hostvedt, to promote Terne during his forthcoming visit to West Germany. «It would be of decisive significance if you (...) clarified the Norwegian Navy's attitude towards Terne as an anti-submarine weapon and gave your assessment of the results from the Key West trials. (...) The German Ministry of Defence has made it clear that if only the German Navy could be convinced that Terne is as good or better than the weapon from Bofors (Swedish/Dutch ed.), a purchase from Norway could be realised immediately. As far as I can see, nobody can do this more authoritatively than the Norwegian Navy.»<sup>147</sup>

The NDRE also complained about KV's sales efforts. After a meeting in Kiel in the summer of 1958, Karl Holberg summarized his grievances about KV in this way: «Because of their lack of competence in all fields, the negotiators from KV have not been able to discover the most elementary forms of deception, nor have they been able to distinguish between what ought and what ought not to be said.»<sup>148</sup> KV had no experience from high level negotiations, was seriously lacking in knowledge about operational and technical issues and knew nothing about the industry as a whole; a fact that led to wrong judgements about the competition from other companies, Holberg wrote. He was afraid of serious setbacks because of the lack of competence:

- «a) The possibilities of selling the system in Germany must be given up without serious negotiations.
- b) A number of our good arguments are damaged.
- c) By giving superfluous information we have strengthened a German industry which will exploit its position on the international Terne market and damage the Norwegian specialized industry.
- d) By sending inaccurate information about Terne one has (...) weakened the authority of KV and the NDRE in this field.»

There are signs that KV strengthened sales promotion during 1958. Representatives of KV were in Paris and Bonn several times to push for the sale of Terne.

The NDRE was involved in the Terne project to the bitter end. Formally, the Establishment should not have become involved in the sales promotion, but some of the researchers obviously felt they had



responsibility for the sale. Most of the complaints voiced against other institutions and persons came from the NDRE.

There were at least three formal reasons and one psychological reason why the NDRE became involved in the promotion of Terne. The steady changes made to the weapons system, the fact that the NDRE had the license rights to the system and the NDRE's position as technical adviser for the Chief of the Navy were the formal reasons. Even more important was the view taken by Finn Lied in 1960 when he presented the sale of Terne as one of the major tasks of the Establishment. «We cannot exist unless somebody uses our excellent results. However, we are forcing our products on the industry and on the customers. This works, but not on its own.»<sup>149</sup>

The NDRE doubted the abilities of all the other Terne sellers, yet, on some occasions, it was actually the NDRE which acted as an obstacle to the overall sales effort. The NDRE wanted to keep the system as secret as possible. In 1960 a U.S. government official complained that he had seen some classified information about Terne in a public magazine. This episode led to stricter routines at the NDRE and even the sales brochure was classified as «restricted».<sup>150</sup>

When KV wanted to sell Terne to Finland in 1965, both the Navy headquarters and the NDRE were against it for security reasons. They were afraid that the Soviet Union could get information about the system through Finland. The Ministry of Defence overruled both the Navy and the NDRE, but sales promotion was delayed because of these discussions. The final decision led to a furious remark in the Navy Headquarters: «Putting it mildly, it does seem somewhat odd that the «producer» of a sensitive weapons system is allowed to impose his will on commercial grounds,» wrote one of the officers.<sup>151</sup>

## **Why did Terne not sell?**

Practically all Norwegians who knew the Terne system were convinced that the system was of high quality. The first trials in Key West in 1958 confirmed that the weapons system was at least potentially very good. Captain Charles Stephan in the U.S. Navy gave this judgement:

«Although important questions concerning the system remain unanswered, two essential attributes of the Terne III system have been demon-

strated. The foremost of these is simplicity, which sets this system well apart from other submarine systems. Simplicity and the complementary characteristics of light weight, small size and reasonable cost, all of which the Terne III system has, are much sought after and, at the same time, rare in present day antisubmarine systems. The second attribute is the effectiveness the Terne III system demonstrated in these tests against submarines of the Guppy and fast attack class. Although this statement of its ability must be qualified in various ways, the fact remains that, under the conditions of these tests, the Terne III system obtained an acceptable hit performance against evasive submarines of these types. These two virtues of the system alone advocate its further development. The fact that the Terne III system demonstrated its capabilities despite definitive handicaps indicates that its potentialities may be greater than the capabilities it demonstrated during project OP/S463.»<sup>152</sup>

The potential was good, but trials on an American vessel in 1962 showed that there were still some serious weaknesses in the system. The U.S.N. officers complained about the sonars and the fuses. The NDRE did not fully accept the criticism. It was argued, for example, that the U.S. navy men did not handle the sonars in the right way.<sup>153</sup> The Norwegian Navy supported the NDRE's judgement of the weapons system. The Chief of the service in charge of submarine warfare, Jens Sele, summarized the results of other tests in 1962 in a much more positive tone than had the Americans. «The Terne weapons system (is) as a whole very good, with qualities that are not to be found on other comparable weapons systems.»<sup>154</sup> Sele mentioned that there were still problems with the fuses and the searching sonar. It was implied in his statement that some work still remained to be done in order to perfect the system.

To a certain extent it is probably right to say that the NDRE and the Navy officers promoting Terne continued to do what had been done ten years earlier with Terne II. They tried to sell a weapons system that did not work as efficiently as it ought to. This is, however, not unusual for sellers of newly developed, complicated products. There were probably other factors that contributed just as much to the failure in the international marketing of the product.

KV and the NDRE started the sales campaign too late. At the outset, Terne was supposed to be ready for production in the beginning of 1957. Delayed deliveries of important parts and technical problems led to a prolongation of the development period of more than a year. In addition, the attitude in the NDRE was to do one thing at a time. First they

developed the system, then they started selling it. The West German Navy, for instance, was very interested in Terne in 1957 as there were no alternative weapons systems at the time. Two years later the Bofors company in Sweden and a Dutch company had developed an alternative and the West Germans had a choice. The official explanation that the missile range of the Norwegian system was too short obviously also played some part.

Finn Lied felt that the competitors used political means more actively than the NDRE. That seems a good judgement, but it was obviously not the only reason. We have seen how Norwegian politicians won the support of the West German politicians. The problem was that the West German Navy rejected the Norwegian system on the basis of professional arguments. After all, the West German purchase of two Terne systems was the result of hard work by Norwegian politicians.

## Conclusion

Some academics maintain that the arms race originates with and is sustained by the technologists of the weapon industry. The theory is that there is not necessarily much demand for the new weapons, but that there is a very strong supply side pushing for production. It is going too far to put this story of the Terne development into such a large theoretical frame, but it is striking how this weapons system was developed without «anybody» ever asking for it. Of course, there was a need for more efficient anti-submarine weapons, but such needs were traditionally met by big foreign defence contractors. Furthermore, when the Norwegian weapons system was developed, only one navy wanted it; the other navies rejected it as energetically as possible.

Nevertheless, the weapons system was developed and it was regarded as a success, a success because the weapons system worked but also because the NDRE and KV acquired influential «friends». A system of supporters was built up around the Terne project, and at the end of the project periode, KV and the NDRE had contacts in the U.S., in the Storting and in the Ministry of Defence. These contacts were vital for the continuation of weapon development at KV and the NDRE.

The historian of technology, Thomas P. Hughes, maintains that technical change is promoted inside a system of different people, institutions, techniques and administrative considerations. All the parts of this system influence other parts of the system. In a dynamic process people inside the system are shaped by each other and by the technology which in turn is shaped by economics, which again shapes the people.<sup>155</sup>

This perspective on technical change serves as a point of reference when looking at the development of Terne. In the very beginning, there were only some researchers in the NDRE who wanted to develop the weapons system. There were researchers inside the Establishment who wanted to give Terne III lower priority. The Navy and the Coast Guard were at times directly opposed to the new weapon project. With good help from the dollar-providing MWDI, the researchers steadily convinced new institutions and persons about the need for Terne. But the researchers themselves were also influenced by the system they had created.

The NDRE grew into a purely military research institute mainly because of increased international tension, but the Terne projects, both Terne II and Terne III, also led to a militarization of the research. The

NDRE was from the beginning strongly supported by the Ministry of Defence, but the armed services were sceptical. Officers tended to doubt the military and operational qualifications of NDRE researchers. To overcome this scepticism, it was probably important for the NDRE to behave and look like a military organization. Although some of the documents from the time give the impression that the NDRE oversaw Navy scepticism, it is worth mentioning that the Assistant Director at the NDRE, Reidar Danielsen, emphasized the need for goodwill in the Navy when he argued for the completion of the Terne II project. After all, the Norwegian Navy had the power of veto – if they had refused to participate in the Terne development, the project would have been stopped.

The Navy had such a «negative power» because of the financial aid from the U.S., which was given on the condition that the Navy supported the project. The establishment of the Mutual Weapons Development Program (MWDP) came as a surprise to the NDRE. The researchers did not expect that kind of support. However, when the possibilities for huge dollar grants emerged, the NDRE obviously emphasized the military aspects of its research more forcefully. The MWDT in Paris was included in the Terne system. For some years the Terne developers hoped all the NATO countries would buy the Norwegian system. These expectations were mainly due to the MWDT. The NDRE also learned how to apply for money through the Terne project – when the Establishment looked for new projects it must have been tempting to embark on projects that could be financed by the U.S.

The inclusion of the Navy and the MWDT in the Terne project explains to a certain extent why KV was picked as the main contractor of the weapon. The company had only 10 per cent of the knowledge required for the production of Terne. The managers of the company were not particularly eager to start on the relatively complicated Terne project. It is likely that Jens Christian Hauge and Fredrik Møller by themselves chose KV to be the main contractor. At this time, Hauge had for several years been working for the modernization of KV. His motives are simple to trace in that he wanted the Terne project to boost the ongoing process of modernization. Møller was a good friend of Hauge but it is likely that the influence from the Navy and the U.S. also made it natural for him to pick a military company as main contractor.

When KV was chosen, the system also had a new member. The director at KV, Bjarne Hurlen, emerged as one of the most active Terne advocates. The interests of KV also became a predominant consideration for the

politicians who supported Terne. The Ministry of Defence got openly involved in the sale of Terne in order to secure jobs at KV.

In other words, KV changed some of the goals of the Terne system, but KV itself was also influenced by the system. The company wanted to take advantage of other U.S.-sponsored military projects. The NDRE emerged as a research & development department for KV during the Terne process. The result was that KV had both a powerful R&D department and contacts with «rich» Americans - it would have been strange if the company had not tried to take advantage of these new possibilities.

In sum, the NDRE, the MWDT, KV and some others developed into a small military-industrial complex. This complex was fully mobilized in the early 1960s when West Germany was forced to buy two Terne weapons. In spite of heavy political pressure the Germans did not buy more than two weapons systems, primarily because the West German Navy was opposed to the sale.

The complex which developed as a result of the Terne project might have been a decisive factor in other military and political decisions later in the sixties. It seems pretty clear that the Penguin project was initiated and developed within the same framework as Terne. Looking at the personalities inside the Terne system it is likely that it has been influential in other political issues as well.

The organizational effects of the Terne project must not totally overshadow the technological effects. The Terne weapon consisted of advanced computers, sonars and fuses. Both the NDRE and KV gained valuable experience in electronics. They acquired skills in the development and production of servotechnical systems.

It was mainly because of the Terne project that the R&D department of KV grew as fast as it did from 1958 onwards. In 1955, 2 men were employed in this department, in 1960 the number was 96 and four years later there were 150 employees in the R&D department. The Terne project was the most important task for this department until 1965; in 1958, 1959 and 1960 practically all the work was concentrated on Terne.<sup>156</sup> When the Terne project came to an end, new projects were needed. Seeing that the employees were experienced in the production of weapons systems it is obvious that they tried to find projects resembling Terne. For example, the R&D department worked on ten different projects in 1961, seven of which were military.<sup>157</sup>

With the benefit of hindsight it is arguable whether this concentration on a big, military project was good for KV. In the late 70s and throughout

the 80s KV had big problems, partly because of projects that were too big and too costly. The fact remains that almost as many as 100 engineers were drawn to Kongsberg in the late 50s and early 60s as a result of the Terne project. Most of these engineers stayed with the company when Terne was finished. This growth in the staff of engineers was a major feature of the transition of KV from a traditional mechanical shop to an engineering company.

## Sources

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I have had access to the relevant files in the NDRE, in the Navy Headquarters, in the Ministry of Defence and at KV. Some documents were missing, but there does not seem to be any systematic lack of documents. Particularly at KV it was difficult to find documents reflecting strategic considerations.

I have interviewed Finn Lied, Willy Simonsen,<sup>158</sup> Bjarne Hurlen and Ingjald Engelsen.<sup>159</sup> Some of the information acquired in these interviews do not correspond very well with information from the files. I have tried to use information from the interviews only to the extent it appears to fit with information given in the documents from that time. I regret that former Minister of Defence and deputy chairman of the board at KV, Jens Christian Hauge, was unwilling to answer my questions.



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## Abbreviations

A/S:	anti submarine
FD:	Norwegian Ministry of Defence
FFI:	Norwegian Defence Research Establishment
FFIA:	The department at the Norwegian Defence Research Establishment in care of anti submarine research
FFIF:	The department at the Norwegian Defence Research Establishment doing research in Physics
FFIS:	The administration of the Norwegian Defence Research Establishment
FFI-K:	Norwegian Defence Research Establishments archive at Kjeller
FFI-H:	Norwegian Defence Research Establishments archive at Horten
KV:	Kongsberg Våpenfabrikk
L/70:	Swedish anti aircraft gun produced at Bofors
MAAG:	Military Assistance Advisory Group
MOK:	Navy Headquarters (Marinens Overkommando)
MWDP:	Mutual Weapons Development Program
MWDT:	Mutual Weapons Development Team
NEBB:	Norsk Elektrisk & Brown Boverii (Norwegian affiliate of Brown Boverii)
NDRE:	Norwegian Defence Research Establishment (FFI)
NOK:	Norwegian Kroner (the Norwegian currency)
NTNF:	Royal Norwegian Council for Scientific and Industrial Research
RA:	Raufoss Ammunisjonsfabrikker
SACLANT:	Supreme Allied Commander Atlantic
SOK:	Navy Headquarters (Sjøforsvarets Overkommando)
STK:	Standard Telefon og Kabelfabrikk (Norwegian affiliate of the ITT)
St.meld.:	Government White Paper (Stortingsmelding)
St.prop.:	Government Bill (Stortingsproposisjon)

## Notes

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25. FFI-K, H-arkiv 1954-55 131-132, Terne: Letter from Gerhardsen to FFI-S 8 November 1954 (132/54/TG/IG).
26. FFI-K, h-arkiv 48-53 raketter «terne» synkeminer: Letter from Sjøforsvarets Asdic Radar Service to the Navy Headquarters 12 January 1949 (404/H223/49/EB/mes).
27. FFI-K, H-arkiv 1948-53 raketter «terne» synkeminer: Letter from the Mine Service to the Headquarters 6 February 1951 (it is enclosed in a letter from the NDRE to the headquarters 19 February 1951 (S-803/-51/FM/jl). Minevesen fryktet at de kunne «så å si blir tvangsforet med prosjekter (våpen) hvis verdi militært teknisk sett ikke står i forhold til den økonomiske belastning de vil medføre.»
28. FFI-K, H-arkiv 1954-55 131-132, Terne: The proposed minutes after a conference 25 May 1955 in Kjeller about the mechanical fuses in Terne II.
29. FFI-K 1954-55 131-132, 132 Sjøminer, torpedoer, anti-ubåtvåpen: Notat (P.M.) on Terne II and III presented to the heads of the NDRE departments 12 July 1954.
30. FFI-K, H-arkiv 1954-55 131-132, Terne: Letter from the head of the anti submarine department (Torpedoinspektør) to the Navy Headquarters 16 October 1954 (H.24/54/404/102/B.E.Y./IA).
31. FFI-H, Terne: Minutes from the meeting in the steering committee of the project 30 October 1956.
32. FFI-K, 1954-55 131-132 sjøminer, torpedoer, anti-ubåtvåpen: Letter from Fredrik Møller to the Navy Headquarters 26 March 1954 (S-132/54/FM/AB).
33. *Aftenposten*, 16 October 1958.
34. FD, Terne: Notat (PM) from Nils Handal to the members of Government concerning the contract with the U.S. on the Terne production. 26 January 1959 (j.nr. 735/59/sak 1).
35. *Teknisk Ukeblad*, No. 22 1966.
36. *Wicken*, 1987 b.
37. *Collett*, 1984.
38. *Lindelién*, 1979.
39. *Wicken*, 1987a. See also: FFI-K, D.A. MWDP: P-M. about cooperation between research institutes (Fellesforskning – erfaringer og synspunkter) December 1957 (T-204/57/FL/SL).
40. FFI-K, 1954-55, 131-132, 132 sjøminer, torpedoer, anti-ubåtvåpen: letter from the NDRE to the Ministry of Defence, 11 May 1954 (S-132/54/FM/AB).
41. Enclosure to the letter in the note above (S/132/54/FM/AB) 11 May 1954.
42. Kongelig res. 21 May 1954 about the agreement between Norway and the U.S. on aid for the development of new weapons.
43. FFI-K, 132-133 t.o.m. 1957, Terne: Letter from the NDRE to the MWDT 22 October 1955 (S-132/55/RFE/AB).
44. FFI-K, 132-133 t.o.m. 1957, Terne: Letter from T.B. Larkin, Director at the MWDT to Møller 19 December 1955 (ser: N-00102).
45. FFI-K, 132-133 t.o.m. 1957, Terne: Letter from the NDRE to the MWDT 13 January 1956 (S-132/56/RFE/AB).
46. FFI-K, Fortrolige dok. 1956: Letter from the NDRE to the Ministry of Defence 27 March 1956 (132/55).
47. FFI-K, 103-132.204 1958, 103: The quarterly report from the Administration at the NDRE.
48. FFI-K, Fortrolige dokumenter 1957, 132 (II): Letter from the Administration at the NDRE to KV 18 November 1957 (S-132/57/RFE/AB).

- KV: Minutes from meeting at the Oslo office of KV 6 December 1957, written by Kristian Søgne.
- KV: Minutes from meeting in the offices of SIMRAD 10 December 1957, also written by Søgne.
- 49. FFI-K, A.D.: Report from Hauge after the meeting in Paris, 20 January 1958.
- 50. FFI-K, D.A.: Report after the meeting with the MWDT 03 February 1958 (-/58/FFI/S/FL/AB/204-MWDP).
- 51. FFI-K D.A.: «Project Proposal Terne 3 – Preproduction Models for Service Tests» 11 March 1958 (-58/FFI/F/RFE/AB/204-MWDT).
- 52. FFI-K, D.A.: Letter from Lied to deputy Minister of Defence Sivert Nielsen 20 March 1958 (-/58/FFI/S/FL/AB/132:204-MWDP).
- 53. FD, Terne: letter from American Embassy to Ministry of Defence 12 December 1958 (Nos. N-06-MWP-N-59 and N-07-MWP-N-59).
- 54. FD, Terne: Letter from the NDRE to the Ministry of Defence 6 January 1959 (-/59/FFIS/RFE/AB/132:204).
- 55. FD, Terne: Letter from the NDRE to the Ministry of Defence 16 December 1958 (H-/58/FFIS/RFE/AB/132:204-MWDP).
- 56. *Op. cit.*
- 57. *St.prop.* No. 30, 30 January 1959.
- 58. *FFI mikroskopet*, December 1963.
- 59. FFI-K, 1954-55 131-132, 132 Sjøminer, torpedoer, anti-ubåtvåpen: Enclosure to the minutes from the meeting in the steering committee of Terne 31 July 1954.
- 60. FFI-K, H-arkiv 1954-55 131-132, Terne: Minutes of meeting with US representatives 8-11 February 1955 on the project Terne III.
- 61. FFI-K, Fortrolige dokumenter 1957, 132 (II): Enclosure to a letter from the NDRE to the Ministry of Defence 25 June 1957 (S:132/57/FM/TJ).
- 62. FFI-K, Fortrolige dokumenter 1957, 132 (I): Enclosure to letter from the NDRE to Kelley 5 June 1957 (S-132/57/RFE/AB).
- 63. FFI-K, Fortrolige dokumenter 1957, 132 (II): Enclosure to letter from the NDRE to the Ministry of Defence 21 November 1957 (S-132:204/57/RFE/AB).
- 64. FFI-K, 132-133 t.o.m. 1957, Terne: Letter from Møller to the Ministry of Defence 29 September 1956 (S-132/56/FM/EH).
- 65. KV: Report from the Yulke company. Not dated, but it must have been from 1953.
- 66. FFI-K: Minute from the meeting in the steering committee 10 January 1956.
- 67. Hurlen interviewed 10 March 1987.
- 68. FFI-K, 132-133 t.o.m. 1957, Terne: Letter from the NDRE to KV 6 March 1956 (S 132/56/RFE/AB).
- 69. *Wicken*, 1987.
- 70. Bjarne Hurlen interviewed 10 March 1987.
- 71. *St.prop.* No. 1, tillegg no. 48 1953.
- 72. *Wicken*, 1987 p. 64.
- 73. *Lindelién*, 1979.
- 74. *St.meld.* No. 12, 1958.
- 75. *St. Prop.* No. 74, 1958.
- 76. *Ibid.*
- 77. KV: Report after visits to the NDRE in Horten and Kjeller 24 and 25 February 1956. 1 March 1956.
- 78. *Ibid.*

79. FFI-K, Fortrolige dokumenter 1956: Letter from the NDRE to KV 12 October 1956 (S-132/56/FM/AB).
80. KV: P.M. (Notat) 29-10-56, signed KS/rju.
81. FFI-K, Fortrolige dokumenter 1957, 132 (I): Minute from the meeting of the steering committee 2 September 1957.
82. *Ibid.*
83. KV: Brief on the Terne project 4 December 1957, KrS/ca.
84. KV, Information on Terne to the members of the Board at KV, signed by Hurlen 27 April 1958.
85. *Op. cit.*
86. FFI-K, Fortrolige dokumenter 1957, 132 (I): Letter from the NDRE to the MWDT 5 June 1957 (S-132/57/RFE/AB).
87. Interviewed 10 March 1987.
88. *Wicken*, 1987 a.
89. FD, Terne: Letter from the NDRE to the Ministry of Defence 16 December 1958 (H-/58/FFIS/RFE/AAB/132:204-MWDP). A Government employee disputed a statement in this letter that it was possible to qualify KV as a military company.
90. Norsk Produktivitetstuttt: Report from project no. 29, January 1956.
91. KV: Information to the members of the Board on Terne 27 April 1958.
92. FFI-K, Fortrolige dokumenter 1958 Terne (III): Letter from Hølberg to Lied 10 June 1958 (-/58/FFI/T/KH/SL/132).
93. NTNf/S-arkiv/1-16 servoteknisk forskning: Letter from E. Klippenberg to F. Møller 4 November 1953 (j.nr. 5764 sak nr. S 53).
94. *Ibid.*
95. *Wicken* 1987 b p.30.
96. KV: Report after a meeting with Lieutenant-Colonel Jørstad in Paris 23 September 1960. The report is dated 27 September 1960 and it is not signed.
97. *Bergh*, 1987 p.84.
98. *Ibid.* p.264.
99. *Nyhamar*, 1983, p.63.
100. *Ibid.* p. 112.
101. *Ibid.* p. 145.
102. «*Hvem er Hvem*» the Norwegian version of «who's who»: Some of the persons interviewed says Hauge was in Paris from 1956 to 1957)
103. *Wicken*, 1987 a, p. 40.
104. *Randers*, 1975.
105. *Flagestad*, 1988.
106. FFI-K: Fortrolige dokumenter 1959, 132 (I): Letter from KV to the NDRE 3 January 1959 (ref. Hu/rju).
107. FD, Terne: P.M. from Finn Lied to Nils Handal 10 September 1959 (H/59/FFIS/FL/AB/132).
108. FD, Terne: Letter from the NDRE to Ministry of Defence 4 November 1959 (-59/FFIS/HP/BA/204 KV).
109. SOK/H-arkiv j.nr. 03352 / F Arkiv 132: Enclosure to letter from the NDRE to the Navy Headquarters 14 August 1961.
110. SOK/H-arkiv j.nr. 03327 / F Arkiv 132: Comments to a letter from the anti submarine service (Marinens Minevesen) 16 August 1961.

111. FFI-K, Notater til 31/12 -62: From Finn Lied to the head of the Navy 2 January 1962 (-/62/FFIS/FL/LG/132). The minutes from the meeting in the council for the NDRE (Forskningsnemda) are not to be found, but Lied refers to the meeting in this report.
112. *Ibid.*
113. KV: Annual report from the R&D department to the Administration.
114. FFI-K, fortrolige dokumenter 1960, 132: Minutes from the meeting of the steering committee 22 March 1960.
115. SOK/H-arkiv j.nr. 004583 / F Arkiv 132: Letter from the Naval school and the anti submarine service (våpenskolesenteret og Minevesenet) to the NDRE and KV 27 October 1962.
116. FD/H-arkiv /61/731.1: Gudmund Harlem's information to the Government 27 April 1961.
117. FFI-K, Fortrolige dokumenter 1957 132 (II): Letter from the NDRE to the Ministry of Defence 21 November 1957 (S-132:204/57/RFE/AB). Letter from the NDRE to the military attaché in Bonn, S. Førde 25 November 1957 (S-132/57/RFE/AB).
118. FFI-K, fortrolige dokumenter 1958 132 (I): Minutes from the meeting of the steering committee 3 January 1958.
119. FFI-K, Fortrolige dokumenter 1958 132 (II): Report to deputy Ministry of Defence S. Nielsen and J. Modalsli from Finn Lied 5 May 1958 (-/58/FFI/S/FL/AB/132).
120. FFI-K, 132 Terne 1958: Enclosure to letter from the NDRE to the Ministry of Defence 26 November 1958 (H-/58/FFIS/RFE/AB/116:132:204).
121. FD, Terne: Telegram to Sæbø 5 May 1959 (A-3488/59).
122. FFI-K, Fortrolige dokumenter 1959 132 (I): Report from Finn Lied to N. Handal 14 September 1959 (-/59/FFIS/FL/AB/132).
123. FFI-K, Fortrolige dokumenter 1959 132 (I): Report from FFIA to FFIS 25 November 1959 (-/59/FFIA/HN/ABL/132).
124. FD, Terne: Letter from Y. Daasnes to the Ministry of Defence 14 April 1959 (j.nr. 275/59).
125. FD, Terne: Letter from Johan K. Christie in the Ministry of Defence to Handelsråd Rogstad 28 April 1959 (A-3393/59/JKC/AL/702.11).
126. FD, Terne: Report from the military attaché in Bonn to the Ministry of Defence 6 June 1959 (A/H 008424, sak nr. 703.11.1).
127. FD, Terne: Enclosure to letter from the Liason Officer in Bonn to Navy Headquarters 28 July 1959 (3348/59/FST).
128. FFI-K, Fortrolige Dokumenter 1960 132: Enclosure to letter from Lied to Heads of the Departments 11 April 1960 (-/60/FFIS/FL/BA/132).
129. FFI-K, Fortrolige Dokumenter 1960 132: Letter from Lied to Hurlen and the Heads of the Departments 9 May 1960 (-/60/FFIS/FL/AB/132).
130. FFI-K, Fortrolige Dokumenter 1960 132: Report from Seim to KV's Oslo office, Ministry of Defence, Frihagen and the Director 30 May 1960. Auxiliary vessels were the ones used for mobilization.
131. KV: Agreement on the sale of 2 Terne to West Germany 4 December 1961.
132. SOK, H-arkiv jnr. 04543, arkiv nr. 132: Report to the Chief of the Navy from Sele 18 October 1961.
133. FFI-K, Notater 1/1 -63 -68: Report from Lied to Gudmund Harlem 25 June 1965 (H 1288/65/FFIS/FL/BT/132).
134. *Ibid.*

135. FFI-K, DA, notater: Report from Lied to Harlem and the Heads of Departments in the summer of 1961.
136. SOK/H-arkiv, nr. 130: Letter from the NDRE to the Chief of the Navy 3 March 1966 (Jnr. 000816).
137. KV: Report after meeting in Paris 10-12 December 1958. The report is not dated (012.53).
138. FD, Terne: Letter from Christie to commercial attache Rogstad 28 April 1959 (A-3393/59/JKC/AL/702.11). «...ikke minst av den grunn at man akkurat nu på politisk hold er villig til å strekke seg atskillig lenger når det gjelder offisielle norske initiativ enn tilfellet ellers har vært i den senere tid.»
139. FD/H-arkiv, Terne: The decision made 20 August 1959 (A/H 10041/59/FDM 15/SL/KD/703.111).
140. FFI-K, Notater til 31/12 -62: Report from Lied to Hurlen 24 October 1961.
141. FFI-K, Notater til 31/12 -62: Report from Lied to Harlem 19 September 1961 (-/61/FFIS/FL/LG/132).
142. Interviewed 06 March 1987.
143. FD/H-arkiv Terne: Letter from KV's Oslo office to the Ministry of Defence 14 April 1959 (j.nr. 275/59).
144. FD/H-arkiv, Terne 703.11.1 1956-1959: Letter from Rogstad to Christie 11 April 1959 (jnr. 3030/59. GR/NC.).
145. MOK/H-arkiv 132: Letter from Jacobsen to Admiral Ruge 1 June 1959 (MOK/H/86/59/FII).
146. FFI-K, Fortrolige Dokumenter 1960, 132: Letter from Hurlen to Lied 26 September 1960 (The comments referred to are added to the letter).
147. SOK/H-arkiv, 132: Letter from Hurlen to Hostvedt 7 July 1962 (j.nr. 003924).
148. FFI-K, Fortrolige Dokumenter 1958 132 (III): Letter from Holberg to Lied 10 June 1958 (-/58/FFI/T/KH/SL/132). De oppdaget ikke «de mest elementære former for bluff.»
149. FFI-K, DA: Letter from Lied to H.C. Christensen 12 April 1960.
150. FFI-K, Fortrolige Dokumenter 1960 132: Report from the security officer (Gunnar Pettersen) to Finn Lied 8 December 1960 (-/60/FFIS/GP/BJ/359:204-KV:132-Terne).
151. SOK/H-arkiv 130: Enclosure to letter from the Ministry of Defence to the Military Mission in Washington 29 November 1965 (j.nr. 004647). (Det må vel mildest talt kunne sies å være noe betenkelig at «produsenten» av et gradert *militært* våpensystem til syvende og sist får sin «vilje» av salgsmessige grunner.)
152. KV: Speech by Charles Stephan USN at NATO meeting in Paris May 1959.
153. FFI-K, Notater 1/1 -63 til 68: Report from Klippenberg to Lied and Hurlen 30 Mat 1963 (-/63/FFIS/EK/BT/132). The NDRE thought that Norwegian navy men were more skilled than the Americans in interpreting the signals from the sonar.
154. SOK/H-arkiv 132: Report from Sele to the Chief of a coastal guard (Kysteskadren) 12 June 1962.
155. Hughes, 1986.
156. Based on annual and quarterly reports from the R&D department.
157. The annual report for 1961.
158. Founder of the sonar-producing company SIMRAD.
159. Researcher at the department of anti-submarine fighting in the NDRE.



## The Making of Terne

Terne was the first weapons system ever developed and produced in Norway. A modernized version of Terne is still on board Norwegian naval vessels for use against submarines. When it was developed in the late Fifties it was regarded as one of the best anti-submarine weapons in the world.

This study concentrates on the organizational aspects of the development of Terne. The weapon system originated in the Norwegian Defence Research Establishment (NDRE) and there was no demand for the weapons system. Normally, Norway bought such equipment from abroad.

For seven years the NDRE, and others, mobilized broad support for the production and sale of Terne. Navy officers, bureaucrats in the Ministry of Defence and politicians reluctantly started promoting the weapon system.

The promotion was not successful as far as the sale of Terne was concerned, but the NDRE and Kongsberg Våpenfabrikk learned how to get support from officers and politicians, in this country and in the United States.

This experience was probably decisive when the NDRE and KV started developing and producing the Penguin missile.

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