FMV:Amsäk
Bo Demin, Chief Engineer

2 January 1992

Measures proposed to improve the safety of materiel within the defence establishment

1. Introduction

In compliance with relevant laws (e.g. the Work Environment Act and a number of special laws, such as those relating to inflammable and explosive goods, the transport of dangerous goods, and safety on board ships), various National Defence authorities are responsible, for the safety of materiel and for preventing accidents both in times of peace and war.

In conjunction with the changes now taking place in both the community and the defence establishment that affect this safety work (such as the European Economic Co-operation Agreement, closer relations with the EC, a new law concerning products, Business Concept -90 and the FMV-90 organization) an complete review should be made and co-ordination carried out to improve this work.

The object of this article is to shed light on the areas involving the most acute problems and, if possible, propose remedies.

2. Distribution of responsibility

Responsibility for the safety of materiel, which is shared among the central authorities, such as the Supreme Commander of the Armed Forces, Commanders-in-Chief of the Army, Navy and Air Force, and the Swedish Defence Material Administration (FMV), needs to be made clear, for reasons that include the responsibilities of the authorities during the various phases of the materiel's service life.

The present distribution of responsibility in accordance with the government's defence activities ordinance is not in accord with relevant legislation.

Furthermore, the distribution of responsibility among central, regional and local authorities must be regulated to take into account Business Concept '90 and other considerations.

Finally, responsibility within FMV must be regulated, with regard to the FMV-90 organization (for example, what safety work implies for a person responsible for materiel systems).

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1992		**00-00-1992 to 00-00-1992**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Measures Proposed to Improve the Safety of Materiel Within the Defence Establishment	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **FMV,Swedish Defence Materiel Administration,SE - 115 88 Stockholm, Sweden,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADA260985, Volume II. Minutes of the Twenty-Fifth Explosives Safety Seminar Held in Anaheim, CA on 18-20 August 1992.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**6**	

In distributing responsibility, efforts should be made to achieve the greatest possible co-ordination between the defence services, such as in the matter of airworthiness approval, seaworthiness approval, safety approval of other defence materiel, and decisions on the use of the materiel. Another important co-ordination matter is work on Safety Instructions, its formulation, distribution and follow-up, and the further development of this work.

3. System safety activity on all defence materiel

Modern defence materiel is becoming ever more technically complicated, in the form of systems in which electronics and software are already used in applications that are critical to safety.

Systematic safety work must be carried out to meet the requirements on safety examination as regards airworthiness, seaworthiness or other safety approval.

Within the American defence authorities this activity is regulated in accordance with MIL-STD 882B 'System Safety Program Requirements'. Basically, this technique implies:

- that safety is considered as one product quality among others, which can be specified and verified,
- that general constructive requirements to reduce risks are compiled in manuals, standards, etc.,
- that systematic methods are used to survey accident risks and assess the need for measures to reduce risks, and
- that a formal, object-related system safety plan necessitates special reporting of plans for and the results of activities that affect safety.

This technique is today fully applied in the development of JAS39 Gripen and the development of ammunition.

To satisfy the requirement on safety it should be applied to all defence materiel to the necessary extent.

Demands should therefore be made on the execution of system safety work on all defence materiel.

To facilitate the introduction of this activity, a system safety manual should be produced.

4. Electronics and software in applications critical to safety

These applications are becoming increasingly common, such as in the control system for JAS39 Gripen, computer system in the coastal corvettes and submarines, computer systems in robots, torpedoes, etc.

From a safety point of view, this problem area is at present the most difficult one to analyse.

Extensive international study and development work has been carried out to formulate requirements and methods of examination within this field to better enable evaluation of the safety of the system.

Within FMV, this activity should be co-ordinated and regulated as soon as possible, with the necessary service instructions, detailed instructions and personnel examination resources.

5. Resources in companies doing development work

To be able to apply this system-safety technique to the full, companies doing development work require the necessary resources. These resources must meet requirements on examination of details, e.g. of an ignition system, but also examination of a whole system, such as a coastal corvette, a combat vehicle, a complete robot system, with reconnaissance and fire-control radar and the actual robot itself. This implies requirements on the resources of shipyards, the combat-vehicle industry, etc.

Furthermore, this activity must be worked into the rules for development that exist in each company (e.g. in a product production manual).

6. Inflammable and explosive goods

As a result of the new law relating to inflammable and explosive goods, the National Inspectorate of Explosives and Flammables must revise its directives. FMV must participate and guard special defence interests in this work. As a result of this, IFTEX (Instructions for the transport and storage of explosives) and BVKF (The defence establishment's joint regulations for actions against the risk of fire and explosion, water contamination and chemical effects on health by inflammable goods etc.) must be revised, in which the instructions issued by the Cabinet Office concerning the formulation of the instructions must be taken into account.

These instructions affect other corresponding instructions at FMV, such as the new Weapons and ammunitions safety manual and Rules for surveying ammunitions.

The development of Insensitive Munition (IM) (known in Sweden as low-sensitivity ammunition - LKA) is being carried out to impart to materials containing gunpowder or explosives greater peacetime and, above all, greater wartime operative safety.

The introduction of such ammunition is of decisive importance for the survival of weapons-carriers (e.g. Combat vehicle 90, new tanks, JAS39 Gripen, new surface attack vessels, new submarines), the Supreme Commander should as soon as possible issue a policy document concerning the stipulation of requirements on new ammunition and the modification of existing ammunition.

To be better able to examine the safety (and performance) of the explosives that are to be used, explosives for military purposes should be subjected to qualification.

7. Weapons-environment work and testing

Basically, safety may be verified in two ways:

- theoretically, by means of analyses, and
- practically, by testing.

Testing includes checking that materiel will be able to withstand the environment they will be exposed to in their service life.

The more complicated the material and the more electronics it contains, the more important it is that weapons-environment work be carried out in a correct manner.

This activity should be better managed and co-ordinated at FMV.

The testing directorate should be given responsibility for:

- advising project leaders on weapons-environment work
- preparing and co-ordinating norms (standards) in this field, and
- co-ordinating test equipment, both within FMV and between FMV and the defence industry and other testing organizations, such as the Swedish National Testing Institute (SP), the National Defence Research Institute (FOA) and certain universities and colleges of higher learning.

8. Rules for following-up the safety status of materiel

Materiel must be continually followed up to ensure that it satisfies the safety (and performance) requirements that its object places on them.

In the field of ammunition, this activity is controlled by the 'FMV rules for ammunition surveillance', which stipulates general requirements on the activity, including the requirement that in the development of ammunition, a plan for following it up shall be prepared and contain safety (and performance) criteria.

In a corresponding way, to the extent that it does not already exist, controlling general regulations should be prepared for other fields (e.g. weapons), stipulating the general rules governing this activity.

9. The new Product Responsibility Act

As from 1 January 1993, a new Product Responsibility Act is to be introduced in Sweden which is in broad agreement with EC product responsibility directives.

Basically this law implies that companies that develop products shall, for the first 10 years, bear responsibility in the event of the product causing injury/damage as a result of a fault in design or production.

This makes demands on industries that do product (system) safety work.

Here, the way in which the responsibility and safety work is to be shared between FMV and industry must be regulated. This issue affects main agreements and order contracts for both development and modification work. Furthermore, it affects FMV's way of working with industry, such as in the amount of 'detailed control'.

Other issues are the extent to which FMV workshops have the necessary resources for analysis etc. and what happens after the statutory limitation time has expired.

10. Safety Instructions work

As of 1 October 1991, the Commander-in-Chief of the Army has appointed a safety inspector to achieve better control of Safety Instructions work and, above all, to gain greater understanding for the instructions and apply them better.

To be able to achieve a better balance within Safety Instructions systems, this inspector should bear total responsibility for co-ordination and not only responsibility for the parts of Safety Instructions for which the Army Staff is today responsible. This applies to design co-ordination, distribution, revision cycle, etc.

Furthermore, it is intended in the army's field to work the technical parts of Ammunition clearance into the Safety Instructions. Corresponding adjustments should be made in the other armed services.

In the short term, relevant calculation bases for factors in the Safety Instructions that affect safety, such as k, V, U, Q, noise, pressure, etc., should be cleared up.

The distribution of responsibility in carrying out follow-up work at FMV and the methods employed at it must be examined.

In the long term, follow-up should be carried out on the present 'philosophical' studies of Safety Instructions being made in Australia and within NATO (Supreme Commander) that are intended to result in

- the 'user' specifying a desirable risk level in the intended training case,
- meeting this requirement by determining real risk criteria for various types of risk and using a suitable mathematical model to adapt them to data processing.

11. Consequences of the European Economic Co-operation Agreement and closer ties with the EC

The implications of the European Economic Co-operation Agreement include the requirement that Sweden follow EC directives such as the Machine directive. In verifying safety (testing), European standards shall also be applied.

Here, a review must be made quickly of the directives and standards that must be followed and a policy prepared to indicate how these shall be applied to defence materiel.

In this context, the work being done within NATO and on the co-ordination of the European defence industry must be followed up.

12. Orientation of research in this field

The US Critical Technologies Plan (CTP), contains several technologies that affect safety work which are not contained in the Swedish research orientation, for example:

- semi-conductor materials and micro-electronic circuits
- software producibility
- weapon system environment
- high-density materials (e.g. IM application)

It is worth considering whether or not to orient Swedish research towards these fields as well.