

Strategy Booklet no. 67

**DUAL USE TECHNOLOGIES IN THE
DEFENCE INDUSTRY**

DUAL USE TECHNOLOGIES IN THE DEFENCE INDUSTRY

“Dual use technology” is of great importance at present as it: reduces the cost of resources to equip armies and facilitates conversion of certain defence material industries to produce for the civil market.

“Dual use technology” is a concept which has been used for some time and refers to technology that has military as well as civilian applications. Reality shows that most technologies are double use.

Generally, technology itself is not assigned to civilian or military purposes, it is simply technology applied to one purpose or another. What in practice leads to classification of a technology is its origin and mainly its general use: the field of defence, or civilian or commercial use.

The requisite of being able to reconvert a substantial part of the military industry, as its production capacity exceeds present demand, has brought to light the enormous possibilities of use in civilian sectors of advanced technologies developed and applied to defence systems. Meanwhile, the need to reduce the costs of obtaining and supporting defence systems has led to resorting to civilian products and technologies to satisfy part of these demands.

However important the products and technologies may be, full knowledge of the theory and their capacity of application is considered of even greater interest. That is to say, the staff trained to master and use them, which must be able to achieve new developments and improvements on the existing ones. Reconversion of scientific technical and management personnel from the military to the civilian technological area is thus of great importance. A key factor in this process is for the staff to have sufficient knowledge of the usual management practice in the commercial sector.

When acquiring a new defence system, one must take into account a series of conditions among which the following must be emphasised: that they fully satisfy the operative needs, that their cost be as low as possible, that they involve a technological innovation to surprise the enemy, that it be easy to maintain and operate and, lastly, but not the least important, that the investment made in acquisition and later logistical support contribute to the greatest extent to the economic and technological development of the country.

INTRODUCTION

(BENJAMÍN MICHAVILA PALLARÉS, Major General, General Staff Officer,
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Analysis of the situation

At the beginning of the eighties, nobody would have foreseen, considering the perspectives offered by the renovation impulse of community policy, which was ready to span the last stretch to European unity, that the fall of the communist empire in 1989 and the economic crisis that began in 1992 would overthrow the hopes the defence industry had placed in work the Independent European Programme Group (IEPG) had been performing since 1976.

Thus, the European defence industry is in a worse state than it was during the eighties as, in addition to the problems raised by competition, technology and structure, it is facing a drop in demand, fundamentally due to budget cutbacks, which make solutions to the problems even more difficult.

Spain has an even more difficult starting point, if that is possible, as in addition to the greater depth of the traditional problems related to the main European defence industries, one must mention the special gravity of the economic crisis. This stifling and pessimistic panorama may not lose sight of the fact that countries still need to defend their interests, as these are not only their own, but also those arising from membership of supranational groups. We are witnesses to the fact that conflict in the world has not decreased toward local conflicts, from what was previously a permanent threat contained by dissuasion.

The market at home and abroad

It seems that the domestic demand of the defence market will continue to be conditioned by a restrictive budget to maintain it at 1.2% of the Gross Domestic Product (GDP) for some years and it is hardly likely to rise to 1.5% by the end of the next five years, in spite of the goodwill of the managerial force at the Ministry and the need to adapt to the levels of the NATO and Western European Union (WEU) countries.

If we take into account the greater costs of the progressive professionalisation of the armies, there will foreseeably be a contraction of resources for new acquisitions, although there may possibly be an increase in the amounts assigned to refurbishing materials, whether operative or from purchase of surplus items.

The overseas market will not foreseeably exceed the present quotas, which are the lowest in recent years, as there are no reasons to consider there will be a modification of the present limits on exportation to areas in conflict.

This problem, which affects the whole of the European defence industry, is of special relevance due to the greater difficulties in absorbing surplus labour and the social effect on areas seriously affected by the restructuring of other sectors.

Some appropriate measures

At present, the whole of Europe has been swamped by a wave of privatisation aimed at decreasing the influence of the State in the industrial structure, while resources are obtained to reduce the Public Deficit and, thus, the external debt. Thus, as we have seen, mainly in the United Kingdom and France, a large part of the public defence industry has been transferred to the private sector.

The best company is not necessarily the largest one, but the most efficient one, the most flexible at adapting to the continual changes on the market. This requires a constantly critical attitude to question procedures, maintaining the innovative spirit that only agile production cores may guarantee. Diversification into other business areas is a good opportunity to change period frame of mind.

The one's in which national defence industry aimed to cover all the needs of the Armed Forces is over, not only due to the lack of technology, but

due to it being impossible to make the production lines required profitable. It is now time for specialisation, analyzing the products offered with the greatest market possibilities and pouring all the necessary financial and production effort required to forge a leading niche in the sector. Specialisation will contribute to a great extent to solving many doubts now raised by companies when specifying their participation in international programmes.

Technology and the future

Up to now, it seems that users only want highly sophisticated products, without being too concerned about the price although, would they think the same way if they had to cover greater needs with a lower budget? It seems we have reached the moment to adapt to the new demands of the market on reconsider the criteria to apply in defence system research and development from now on. To say this another way, it is necessary to define new technological strategies in accordance with the approaching reality.

One of the main difficulties consortiums have always encountered is related to technological transfers, although this is a reality which must be faced in awareness of what one provides as a partner: technological capacity, market potential and financial solvency. It is important to keep this in mind, especially when the concept of "fair return"⁷, proposed at that time by the IEPG, is now questioned in all corporate circles, the greater their technological power is.

THE DEFENCE INDUSTRY: IDEAS FOR A CRISIS
(MIGUEL GÓMEZ RINCÓN, CIAC Colonel and Ordnance Engineer)

Common policy for defence versus common defence policy

Those in charge of the economies in European countries are obliged to encourage application of their resources to a certain defence policy, a consequence of the security policy agreed.

To the extent that this defence policy in such countries ends up becoming a long term common resource policy, it may be considered a common

7. "Fair return": Reasonable balance which is established in international acquisition or technological cooperation programmes, between the economic contributions to the programme by a country and the compensations it receives, for work as well as technological factors.

defence policy. In spite of the fact that there may be punctual actions in a common defence policy in the day to day events which arise.

Development of a new “European Interest Industrial Basis for Defence

Only a common resources policy with a well defined European objective may manage to structure a long term investment scheme as an indispensable step to face the effort of development of a new “European Interest Industrial Basis for Defence”.

The concept of production capitalism compared with the traditional concept of product capitalism. Arms obtention policies

Only if European arms obtention policies make their demands compatible may there be an industrial base on a European support. The reality is that there is already a certain amount of compatibility, but between the European countries and the United States, not between European countries.

The need for an understanding between industries and the Authorities of the countries

All countries which wish to defend their strategic position in the future must seek a balance between external dependence as to resources and a certain capacity for local production.

New setting for operative needs

Thus, a whole different operative environment must be reorganised, with a new world of specifications which must be prepared, and this will take a long time.

The fact that European countries wish to stick together to face up to external situations of conflict leads to a forceful harmonisation of needs. This forceful harmonisation of needs leads to standardisation and specialisation in industry, but it also means that a lot of on-going projects become obsolete and may even have to be cancelled.

The withdrawal of US forces from Europe

If Europe is to take charge of its own security, the different countries involved will apparently have to assume the undertaking of achieving a homogeneous military capacity of response in relation to all others.

The decision taking process in acquisitions in Europe

The very significant conclusion is that the European countries which invest most in defence have important planning mechanisms with the capacity to establish and maintain long term undertakings. The difference in the existing languages between the Ministries of the Defence of such countries, apart from the problems set forth in the details of the corresponding procedures, is minimal and quite different from that of the EC.

Conclusions as to the European defence market

Only a long term common resource policy in the European countries would allow them to structure a new "European Interest Industrial Basis for Defence".

If the countries do not make their demand compatible, a European industrial basis may not exist. This compatibility now exists in a greater proportion between the United States and the European countries than between the actual European countries.

These are solutions in which a less strong country such as Spain, if it does not know how to negotiate, runs the risk of becoming totally displaced. If one limits the possibility of regenerating the relevant industrial fabric, and thus reducing dependencies of a logistic nature directly linked to the guarantee of operativity in critical situations.

Likewise, a Spanish industry which is present in the future industrial fabric of interest for European defence is a decisive factor to ensure long term availability of qualified labour, a critical resource to improve the competitiveness of the resources in the country.

STRUCTURE OF THE EUROPEAN DEFENCE MARKET
(ALBERTO LLOBET BATLLORI, Industrial Engineer)

Introduction

The factors the Armed Forces must face in order to achieve provision of their defence systems fundamentally amount to three: to define the operative action, the scarcity of resources and high prices. All of these are related to technology, to a greater or lesser extent.

One is not absolutely sure which of the possible operative actions will arise in a real setting. On the other hand, there does seem to be one certain factor: interventions by the armies of the future will not follow the rules of previous wars. Just as a reference, one may quote the most important conflicts in the last 50 years: the Second World War, Korea, South East Asia, the Arab-Israeli wars, the Falkland conflict, Afghanistan, the Gulf War, etc. The future will be different.

A pitiful reality history stubbornly seems to show is that peoples will fight. There is also the weakness of not having been able to guarantee peace. Thus, nations do everything possible, in political and military terms to maintain it. However, they quite often are not able to achieve this.

The scientific development which has taken place in the engineering of high value defence systems at very high prices is also providing the civilian field equipment, systems and new technologies of increasing quality. With such reliability, robustness and easy handling indexes, they are apt for use in defence. These, in turn, are at prices several times lower than the equivalents used by the Armed Forces, which are specifically manufactured for them.

Application of these elements from the civil sector to that of defence may be done directly or by transformation. This has the advantage, not only of reduced cost, but also of immediate or short term availability with the facility of obtaining multiple supply sources. These possibilities are some of the initiatives which were timidly launched in Defence some years ago, in order to improve the obtention and cost reduction processes. This is now rapidly becoming generalised.

The use of commercial elements in defence is dealt with in chapter four of Strategy Booklet no. 41 (January 1992) by the IEEE "Technological industrial structure of defence, in relation to strategic evolution at the end of the 20th century"). This analyses the possible percentages of use normally made of commercial components in the different types of military application, a summary of which is as follows:

a) In arms systems, combat pads and immediate combat support systems,

from 5 to 7%, fundamentally at component level.

- b) In logistic support systems, for support in directing and managing operations the support bases for the Forces, from 30 to 50%.
- c) In administrative support systems, at auxiliary support bases and in auxiliary services, from 65 to 75% of the commercial elements in comparison with the total amount.

The possibility of using commercial products in defence requires a very ample and up to date knowledge of the offer on the market, due to the dynamic nature of this sector. Such circumstances require the Authorities to have an ample technical consulting and user engineering capacity available. Such capacity may be achieved by means of adequate organic resources and complementary technical support by regional organisations and specialised companies.

Technical support by the Authorities has taken on a specific characteristic in each country. France, for example, has a powerful structure of organic engineering in Defence (the Ministry and the three Force). The United States, in addition to its organic capacity, is supported by large consulting and engineering companies - the MITRE Co., for example, non profit company under the auspices of the USAF, which supports the Armed Forces and the AFA. For more than twenty years, Germany has had the state company IABG. In Spain, the Ministry of the Defence has had the ISDEFE since 1986, a company owned by it, which also supports diverse organisations within the State Civil Administration.

Such technical support is necessary in the different phases of obtaining and modifying systems, right from the start, from establishment of needs and approach, up to organisation of the integral logistical support, if one wishes to achieve fine tuning of costs and run the minimum risk in decision taking.

On one hand, use of double use technology in defence substantially improves costs and deadlines and, on the other, makes it more consulting services and user engineering necessary.

Main characteristics of the European Defence Market. European disarmament

One may notice three differentiated groups of nations in Europe, according to the present capacity of their industrial and technological, military and defence interest fabrics.

One, formed by Germany, France and the United Kingdom, has an active, full spectrum industrial and technological infrastructure in the field of defence, with acquired market positions, a clear surplus capacity and an internal market which lacks sufficient demand to allow them to maintain their present structures in the area of Defence.

These nations are clearly in favour of extending the European defence market, preferably toward a unified market, free of the present protectionism and captive market held by the States, in which industrial competitors would be practically reduced to themselves, especially due to the strict limits and regulations concerning products of this type from outside the EC for strategic, market and sovereignty reasons.

There is another group formed by Italy, Denmark and Netherlands, which has a complete technological and industrial infrastructure in the complementary sectors to the above group. An extension of the single European market to the defence sector would raise their level of participation in the areas of this market they now occupy and control.

There is a last group of nations comprised, among others, by Greece, Portugal, Turkey and Spain, with an incomplete military and defence interest industry. This, to a great extent, is the most technologically advanced industry in said countries, which is necessary to guarantee the sovereignty and operativity of its armies, as well as the advance and development of its technological fabrics and national industries. These nations are not interested in extension of the defence market due to the low competitiveness of their products and slight implementation on the market, which would possibly lead to the disappearance of the national industries in that sector.

These present situations in the European defence setting may give rise, at a general level, or in a specific way in some nations, to a phenomenon of structural disarmament with the bankruptcy of the defence related industrial and technological fabric. This in turn could lead to a unilateral European disarmament which would leave the nations of the EC much weakened to deal with the new threats and conflicts in the changing world, lacking the resources of Force to back their policies.

The Spanish case

The Spanish case is characterised by it having industry of military and defence interest, which is incomplete but advanced and wide ranging, com-

prising a high percentage of the most technologically advanced industry in the country.

The present level of competitiveness of its products is low, it mainly confining itself to specific technological niches such as:

- Biotechnologies.
- Fabrics.
- Composites and composite materials.
- Low cost, short and medium range air transport platforms.

In general terms, its production infrastructure is obsolescent and is not consolidated in some cases. Its production methods are also usually out-dated, all of which leads to low productivity.

The defence industry is ultimately affected by continued investment budget cutbacks, as well as by a practically non-existent availability of own resources for investment and almost exclusively dependent on decreasing budget assignments by the Administration for specific programmes. All of this conditions direction of possible investment toward lines of work marked by possible or existing contracts.

Thus, due to the limited nature of the Spanish industrial defence fabric, the efforts at development and investment in it, it should aim at a limited number of technological areas, with characteristics such as the following:

- Reducing the rate of investment in infrastructure to the extent required.
- To make the most of the products, techniques and means of manufacturing obtained.
- To encourage the age of double technology to the greatest possible extent, building in this trend from the first stages of planning and technical specification.
- To define needs with sobriety, valuing the cost-efficiency ratio and present technical possibility for manufacturing.
- Optimising the investment-time ratio in execution in order to ensure that the products begun are finished and used operatively in the shortest time possible.
- To adapt contract arrangements to the product delivered.

So these efforts are taken advantage of simultaneously with the knowledge and technological and industrial infrastructures generated it and course of Spanish participation in international projects; which both companies and the Spanish Authorities are involved in, in order to improve the industrial fabric and the existing national technological infrastructure.

Analysis of the evolution of the fundamental technologies of military interest and/or application for defence

The present current concept of MTR (Military Technical Revolution), set by the Centre for Strategic International Studies (CSIS) in Washington, sustains are the fundamental technologies medium and long term on the battle field all those which encourage and provide the possibility of systems for :

- Information and intelligence, allowing centres for: control and monitoring, as well as merger, evaluation and supply of intelligence in real time, with integrated control networks.
- Arms and attack built it with intelligent and/or exotic arms.
- New launching pads, with an increase in distance of use, precision and consequently more lethal.

Conclusions. Some recommendations in the Spanish case

Considering the above, there seems to be an evident need for reconversion of the industrial sector for defence in the EU, in which it is deemed necessary to take the following reflections into account:

- Achievement of a rapid rise in the technological levels of Spanish industries in the defence sector through accelerated programmes to acquire, assimilate and provide technological incentives, based on new external sources of supplies, not always from the classical suppliers which have caused frustrating technological dependencies.
- A centralised, common planning of the operative needs of the three forces is considered necessary, to allow:
- Availability of a larger proportion of products, equipment and systems, whether standard or plain, in their inventories, with the consequent decrease in prices per unit and improvement in the logistical support conditions.
- Harmonising such needs with the potentialities of the fabric of the Spanish defence industry, which must partially bear the sustain the resources, equipment and systems to allow the Armed Forces to carry out their function.
- To contribute to concentration of the Spanish industrial defence fabric, which would support the increase in competitiveness by the products it generates.

Covering the aforementioned need would allow enjoyment of some of the advantages mentioned at European level, within a purely national setting.

- The important disciplines in the Spanish case, due to the operative needs of our Armed Forces and the characteristics of the Spanish industrial fabric, are:
 - Integration of equipment, components and systems.
 - Integrated logistic support.
 - Training and support for training.
 - Modernization and modification of equipment, components and systems.
- Providing incentives and encouraging lines of development to allow creation and standardisation of control, monitoring and communications networks and systems.
- Improvement of the capacity to sustain the arms and support systems of these which exist in the Spanish Armed Forces inventory.
- There must be promotion of the technological area of software in general, especially that of: encapsulated software (built in-sunken and firmware), in order to produce a modern, responsible, innocuous software (in accordance with the SAFETY) conditions, resistant to failure, with self diagnostic and modification features; and those of the mechanised software production field, as a strategic area, due to the impact of extension of its application and the low intensity of investment in infrastructure.

Finally, as a reflection, we would like to suggest promotion of technological and engineering capacity in defence, in order to improve the efficiency of the operative systems, reduce the costs of acquisition and logistic support, contribute to industrialising the country, to facilitate growth of the technological level and provide the Spanish economy a healthy share.

Technological capacity and user engineering in defence has two components: the organic part and the complementary part. Both contribute to optimising the need-cost equation, which nowadays involves employment in defence, with an important increase in double technologies.

CONSIDERATIONS FOR APPLICATION OF DUAL USE TECHNOLOGIES
(BENJAMÍN MICHAVILA PALLARÉS, Major General, General Staff Officer
and JOSÉ MARÍA GRANDA COTERILLO, Graduate in Physics)

Introduction

Two reasons must be raised in this analysis from the point of view of the Administration:

- Budget reductions in military investment due to the economic situation and recent worldwide changes.
- The need to obtain greater efficiency in application of scarce financial resources.

If one takes it for granted that it is necessary to modify the structure of the Forces in depth, one must analyze the new conditions for orientation of logistic organisation. As the general trend is to reduce the defence budget, a distribution must be sought between expenditure on force and expenditure on support to provide maximum efficiency in the missions assigned, so neither of these two partial expenses reaches its maximum.

Such logistic organisation includes all actions following definition of operative needs, as well as distribution of powers among the different bodies responsible. The actions begin with approval of the JSP and lead to approval of the annual budgets, thus covering a first stage. In the second, special emphasis is given to obtention programmes: their organisation, monitoring and control. There is a third stage aimed at distributing the material to ensure maintenance on the first levels and to attend to operativity by providing the consumables required, mainly munitions and fuel. Finally, there is a fourth, which deals with large repairs and modernizations, normally carried out by the industry.

Obtention process and logistics

At present, in logistics, great importance is given to military “obtention and deployment” of large systems, slightly setting aside all reference to acquisition, distribution of equipment and spares and maintenance, which is grouped under the classification of “sustenance”. The practical reason is simple as, when large systems are acquired, due to their economic incidence and image, especially in the cases of high technology, high politics is carried out, while all sustenance related matters have scarce resonance outside the military organisation.

The general criteria applied to the process are as follows:

- a) “Planning” is based, above all, on the realistic possibilities of obtention, according to the “state of the art”, the capacities of the national industry

(in R&D as well as in production), the possibilities of cooperation and the deadlines for execution and delivery in accordance with the force objectives, always within the financial estimates.

- b) "Programming" must be carried out based on the economic resources assigned to such ends in the Ministry of the Defence Budgets and based on the proposals of programmes prepared by the Armed Forces Headquarters.
- c) "Monitoring" industrial and technological activity in the programmes must be carried out at the organic levels, with the decentralisation that allows greater efficiency and favours decision taking.
- d) "Surveillance" of the process attends to achievement of the technical characteristics foreseen, within the timeframe set, to the quality specifications set in the requisites.

Analysis of the present Spanish logistic structure

In addition to participation by the Secretary of State for Defence and the Director General for Arms and Material in the general logistic process, at the level we may classify as political or upper, within force there are two or three logistic units, plus another three or five actually related to maintenance activities. This diversification must be suppressed by introducing only three levels throughout the whole Ministry, to cover all the activities from determining needs to withdrawal or cancellation of material in service.

Centralisation and decentralisation

There has already been a hint at the convenience of seeking maximum coordination in all logistic actions. This coordination must be in addition to decision taking at the highest political level, along with control-management linked to the political and upper levels of the Logistic Support headquarters and execution by that level which reduces delay through the most complete possible knowledge of the material to obtain a greater efficiency.

In determination of requisites, as well as selection of solutions, it is obligatory to receive support from the specialised part of the actual organisation and for it to be located at the maximum level of decision taking, specifically in a synthesis of the competent bodies at the Armed Forces General Headquarters, the Secretariat of State for Defence and the General Headquar-

ters of the Army, Navy and Air Force, without it being convenient to make use of outside organisations or public or private service companies.

The need for common logistic systems for the three Armed Forces

We thus encounter an organisation of great importance, due to the missions it fulfils and resources it administers, in addition to being a key factor in achieving the operativity of the Armed Forces. We may even say that it introduces a very clear division of functions as to the material: tactical must “use” equipment made available to it and must “show a lack” to achieve the operational ends, logistics must “supply goods and services” determined necessary on “programme the economic resources” required to achieve these, all with real time transmission of the information to anticipate decision taking as much as possible.

A possible classification for the three levels of echelon in general Logistic Support would be as follows:

- Basic echelon: linked to the Unit supported, organically dependent on its relevant head. It must have the capacity to achieve full mobility, although in peace time it will be based at the geographic location it is deployed at.
- Intermediate echelon: on a national level, although specialised by type of material, with distribution centres located at the geographic spots which improve their efficiency in relation to the Units supported in peace time. These report to the logistic headquarters of each Force.
- Upper echelon: comprised jointly by the logistic headquarters and the Central Office at the Ministry, and the latter shall take decisions as a political authority, through the plans, programmes and budgets and the former shall be responsible for execution and coordination. Special emphasis would have to be made on the programme heads and on continual evaluation of results compared are the requisites set.

Technical staff serving the Ministry of the Defence

All the above leads to proposal of the existence of a training centre for the actual Defence management staff, with Engineering and Quartermasters Corps with the most general and homogeneous view of the process, without forgetting to include staff from the General Corps in this training process, as a parallel matter to their operative action, although also separate,

which does not complete a training, but rather is of an autonomous nature. One would have to keep in mind the relationship with the civil setting involved, comprised of industry, the university or the Administration, so the necessary members of these would also have to be provided access to that training centre, due to their relation to Defence.

Industrial base and technological capacity

In the Spanish case, we are facing such a situation that the "strictly military industrial base" must be comprised of a few companies which work almost exclusively for the defence market and by the actual centres which take part in the third echelon of maintenance. However, due to diversification and the potential for growth of the demand, base must be extended to a great number of companies which are now double function or only civil, until reaching all those which, due to their products and quality, may and wish to form part of that "potential industrial base for defence".

Advantages and disadvantages of industrial diversification

Traditionally, the requisites set for defence material did not take into account the existence of products and services for general use which, due to being very large series and environments, are cheaper and have characteristics similar to those developed to military standards. Mostly, the distinction has been the result of setting excessively demanding user conditions for military material.

LOGISTIC REPERCUSSIONS OF USE OF DUAL USE TECHNOLOGY BY THE ARMED FORCES

(FELIPE MARTÍNEZ PARICIO, Colonel, Aeronautical Engineer and Graduate in Economic Science)

Summary and conclusions

The evolution of the international situation in recent years and the present economic crisis which affects a great number of countries, especially our own, contribute to a great extent to the defence problems and may be summed up as follows:

- Drastic reduction of the budgets for investment in equipment and thus in the size of orders.

- Cancellation of national development projects, as well as those in international collaboration.
- Many industries going bankrupt or leaving the defence area.

Under such circumstances, it is of greater relevance to take advantage of dual use technologies which allow an increasing proportion of civilian equipment to be used at a lower cost, greater reliability and less requirements as to long term programming.

Due to this, it will be necessary to integrate military and civilian industries as much as possible.

- To modify and simplify the defence contracting procedures.
- To modify the technical specifications of the equipment to allow acquisition of existing commercial products.
- To modify the classification requisites for industries so they may participate in civilian industry with no further problems.
- To promote technological centres for defence so that, in collaboration with civilian industry, they may facilitate adaptation of their products to defence applications.
- To decrease the demands as to cession of the intellectual ownership and technical information and manufacturing techniques which are of value to the company.

Considering the capacity and present technological situation of our industry and the economy of the country, the defence priorities in relation to technology should be:

1. To train and have highly technologically qualified staff under circumstances which guarantee their continuity.
2. To have up-dated, flexible, efficient and very coordinated acquisition procedures.
3. A deep knowledge of the capacity and availability of civilian industry covering areas of possible defence interest.
4. Presence in international defence organisations to allow efficient negotiation, to achieve the greatest balance in relation to import-export.
5. To promote the capacity of the industry to carry out revisions, maintenance and modernisation of the existing material to prolong its life and increase its efficiency. This may mean a very important part of the cost of the full life cycle of the material.

GENERAL CONSIDERATIONS AS TO DUAL USE TECHNOLOGY
(MANUEL QUINTEIRO BLANCO, Graduate in Chemist and Nuclear Engineer)

In this, Armies, as well as the Administration, are still organised as was industry in the times when it was difficult to produce anything that worked, as they served “keen”, “local” markets which required them to put all their effort into projecting and producing.

Now industry must evolve on a “saturated”, “global” market and must put all its effort into producing what is demanded, “better” and “cheaper” than competitors from “anywhere in the world” who easily reach here.

Large corporations, a fashion of past decades, dinosaurs which seemed to bound to dominate all (*The New Industrial State* - J.K. Galbraith) began to give signs, under their thick skin, of extensive death throes caused by competition by small and medium sized companies which are much closer to the market, are born, grow or die, their “excellence” filtered by it, in a purification process which shakes those which have not submitted to it sufficiently (*La Empresa ante las realidades de fin de siglo*, B. Roig, IESE).

Style which establishes the need for that “excellence” to survive, has brought obsolescence to many of the old organisation concepts that proposed centralised systems, slaves to bureaucracy which has aged, as may now be seen from the thundering disaster of the countries that “officially” adopted them, and not so clearly to the profane, but indeed so to experts, in western economies, in those firms which have not known how to evolve sufficiently.

The companies which traditionally serve the Armed Forces are obliged, by culture, contracting systems, classification requisites, definition of articles to manufacture, etc., to conserve those obsolete structures and, although some, very few, have fended off difficulties through more or less concealed protectionism, the greater efficiency of those which, without taking into account the procedures demanded by the Administration and Armed Forces, adapting to the demands of an open market, produce at lower costs, make them replace the ones which followed the old system in an increasingly evident manner.

The rhythm of evolution set by the “agile” companies is such that in many areas, it has become incompatible with the procedures used by the Administration for tenders.

Is this possible?

Bringing the operator nearer to the producer, to stimulate the enriching process of knowledge of needs-possibilities should be one of the priority objectives of Army Units in peace time, the real force of which lies in their skills at taking advantage of the real capacities of the rest of Spanish society to the best extent for the purposes of warfare.

Without that mutual knowledge, it will not be possible to take advantage of those capabilities: catalogue purchasing in Defence must go down in history in what has been called the “era of knowledge” (*The third wave*, A. Toffler).

An ever increasing percentage of defence purchases are not directly related to a weapon, but to complete systems for communications, detection and data presentation, planning complex phenomena, protection, etc., which, except for features for military application, exist on the civilian market.

Even within the concept of “weapon”, there are ever more parts of these, related to targeting, detecting and selecting a target, continuous calculation of the impact point, control, ruse and counter-measures, etc., which use components (computers, software, etc.) whose technology is developing more rapidly on the civilian market than the military one, for the aforementioned reasons.

This makes the list of “dual use technologies” unending, covering practically all modern technologies.

There are thus few purely military systems. Most of them have fully entered the dynamics of the civilian setting, which makes systems, or parts of them obsolete, long before they begin to work.

This thus makes a requisite of the concept of continual “modernisation” (upgrading) of the systems used in defence so that, by small (relatively cheap) alterations (software, replacement of some components, changes in architecture, etc.) a system which cost a lot of money to acquire may be kept alive and efficient.

It is in such small alterations that a small company or group of experts who are very close to the operator, is usually much more efficient, in a mutually enriching symbiosis, the only one which may maintain a system operative.

If the trend, as it seems, is toward much smaller armies, they will have to be more efficient, and nowadays, there are means to check whether they are or not. Society will eventually take a hand in the matter, it will want to know how its money is being spent, and will most precisely evaluate the enriching effect of defence expenditure on the industrial sector of the country. The man in the street is getting increasingly better at distinguishing the difference between what is "spent" on defence and what is "invested" in it.

*IDEAS TO IMPROVE THE EFFICIENCY OF THE RELATIONSHIP
BETWEEN DEFENCE AND INDUSTRY*
(FERNANDO DE CARALT CERA, Doctor at Aeronautical Engineering)

Characteristics of industry for defence

As time has gone by, the structure of industries for defence has changed in accordance with the evolution of the arms and systems they have had to produce. Although their initial activity was almost exclusively concentrated on manufacturing munition, explosives and what is known as conventional arms, there is now growing sophistication in arms and the use of a great variety of complex systems using new technologies which have obliged them to modify their structure to try to cover those fields. On the other hand, the arms race is not just, as not long ago, a matter of producing spectacular weapons which were generally unattainable by technologically underdeveloped countries, but, when the nature of the system allows, to seek to achieve less sensational objectives, but ones which, none the less are always valuable to maintain the capacity of the Armed Forces. On most occasions, these are determined by quality, cost, the track record of the arms, equipment and systems, in the present and future.

Civilian projects and non military R&D have followed similar lines in recent years. Those known as technologically advanced in the sixties and seventies -nuclear energy and the aerospace industry, communications, computers- which require great investments in infrastructure, have lost interest, giving way to others -robotics, computing, electronics, material sciences and oceanography- which do not require such large investment as to be unaffordable. Then the advances in each of these fields may be used in large scale projects; for example, if it had not been for microelectronics,

there would never have been communications satellites⁸. Moreover, on most occasions, state financed programmes do not seek to establish a commercially competitive product; their aim is generally to improve the R&D capacity of industries, providing them excellent means to deal with any problem. Due to this, many large projects have been subdivided - this obviously may not be done with all- and they are carried out in sections.

The advantages of this system are most clear, as it is simpler to find companies specialised in a specific technology than others that cover the whole range of technologies required to develop a large programme. Financing is also more affordable, as instead of having to pay large sums, of money to the companies -if such exist- which are able to work on a superproject, less is paid to smaller companies for their work in specific areas which, in addition to increasing the capacity to compete, allows expenditure to be adapted better to budget availabilities. It is true that, as several companies take part in executing the same project, greater coordination is required, although the characteristics of equipment to be built justify subdivision.

Dual use technologies

One of the greatest difficulties in applying civilian technology, what is known as COTS⁹, to military equipment and systems lies in the difference in specifications. Military equipment must generally fulfil much tougher requisites than required of the same equipment and components in civilian applications. On occasions, countries such as Spain where there are not enough military standards of its own, is forced to resort to those applied in other countries which sometimes makes it impossible to find products which fulfil them. There is no doubt that there is certain equipment in which fulfilment of the specification will be unavoidable, although in others, the requisites could be lessened without decreasing the efficiency of the system. What is difficult is to find qualified staff -able to determine whether substitution is possible without the equipment losing value-, brave enough to propose the change, knowing they will bear the blame of any future failure, although this may not be due to that decision.

8. Gansier, J., S., in *Affording defence*, p. 235, MIT Press, Cambridge, Massachusetts, 1989.

9. COTS stands for commercial off-the-shelf. Generally, when speaking of COTS products, they are almost always electronic components.

Another aspect which must be taken into account when analyzing use of civilian products for military equipment -one must not forget that this analysis is from a military point of view, which seems the most demanding-, that the existence of joint development and production programmes requires creation of organisations able to control performance of the work, which may give rise to certain difficulties, due to the different nature of the civilian and military worlds.

Industry for defence in Spain

There are several ways to classify defence industries. According to size, three groups may be distinguished. The first is that of the large firms which are able to build complete weaponry systems; McDonnell Douglas, General Dynamics, Boeing, General Motors are some examples of American companies of this kind; Thomson, British Aerospace, Dassault of European companies; in Spain CASA, Bazán, Santa Bárbara and INISEL may be classified on this level. Most of these companies also take part, with different quotas, on the civilian market. The second group is formed by the main subcontractors, many of which manufacture electronic equipment such as radars and computers.

The last group is comprised of industries which supply components and materials; articles and elements which have the advantage of being used in civilian as well as military equipment such as that described in greater detail above. Another way of classifying the industries is according to the characteristics of the sector they work in: aerospace, munitions, shipbuilding, etc., and there are great differences between them; for example, ships are built one by one, in very short series, when there are any, while munitions are mass produced.

Criteria to develop industries of interest for defence

While change has been the main characteristic of recent years, that of the years to come is uncertain; not only is there an unclear view of where society is heading, its starting point is not well known either. As to security, the collapse of the Eastern bloc has made void the hypothesis maintained since the Second World War as to the most probable enemy one would foreseeably have to defend oneself from. The events have shown that, apart from operations organised by the United Nations or by any other

international organisation in which one may have to participate if so decided, military actions by a nation such as Spain will almost always be limited to defence of its own territory.

Moreover, although the number of programmes has decreased drastically, what one may not dispense with is the capacity to be able to carry these out when necessary; there are certain skills which nobody may afford to lose, although they may not be needed immediately; if this is not so, it would be impossible in the future to plan and build any device with a certain technical complexity. Due to this, at present, as aforementioned, great importance is granted to the R&D at companies so they are able to provide the technical problems which arise as well as to develop new products. The Ministry of Defence must thus try to conserve, and if possible improve and considered of interest for defence.

*CRITERIA TO PLAN DEVELOPMENT OF SPANISH INDUSTRY
OF INTEREST FOR DEFENCE*

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Introduction

Analysis of the situation, faced with the industrial and social challenges we must face at present, involves global evaluation which must take into account all the variables which affect the industry. We must also consider if the objectives, priorities and resources are still in keeping with the way the circumstances are evolving, determining what corrections must be made, especially in technological matters, to successfully deal with such a changing situation.

Recommendations

In order to ascertain the most convenient measures to take, one must take into account not only the increasingly competitive setting, due to greater aggressiveness in prices and the appearance of new competitors, but also due to the comparative situation in relation to community industry and the role played in the worldwide context.

The main measures which must be taken may be summarised as follows:

- The policy must be selective in certain area, not in all, depending on the needs and technological capacities of the country.
- One must promote industries considered strategic due to their diffusion effect in the civilian setting, as well as their applications in the military area.
- In all projects, objectives must be set which are duly quantified and planned, although, fundamentally, one would have to set mechanisms to evaluate the results to be obtained.
- One must not neglect modernisation and renovation of the production lines, which are obsolete to a great extent.
- Technological culture must be encouraged in society.
- Higher education must be linked to industry, to achieve interaction, to allow creation of R&D centres and technology parks, promotion of investment programmes for equipment, etc. Company staff may contribute to the research and teaching work at the university and the professors may be hired by companies as consultants. This collaboration may facilitate more direct and swifter application of research results.
- To promote systems to aid companies which are prepared to launch new products on the market, especially the small companies which must form the industrial mesh, who provide the real scale of the technological power of a country. Thus, for example, these companies must be provide access to specialised industrial services such as design, standardisation, certification, testing, quality control, etc.
- To establish assignment criteria for R&D projects, encouraging applied and applicable research which may become a technical and economic success.
- Improving the criteria used for selecting R&D projects, promoting applied or research which can be applied in technically and economically successful terms.
- To encourage a transparent, orderly market without unfair competition.
- To open up the markets in Latin America, the North of Africa, China and the Eastern European countries.
- To promote standardisation, taking into account the need for “scale economy” and interchangeable equipment.
- To promote the Spanish Network of Test Laboratories (RELE) for compliance by the laboratory accreditation systems with those approved by the international organisations, encouraging consolidation, improvement and increase of calibration laboratories and industrial calibration services.

- To encourage active participation -joint ventures- by companies and institutions in the Framework Programme, in EUREKA and in international programmes which, in addition to providing financing, allow the companies to attain an adequate size to compete with the United States and Japan, as well as obtain access to highly specialised technology, by sharing tasks among companies in different countries.
- To support small and medium sized companies to ensure they are correctly sized to allow them to achieve greater solvency margins.
- To include technological innovations of products, processes and organisation in the industrial activity to develop and include new technologies to launch quality products on the market, in order to raise their added value.
- To promote specialisation in themes and sectors where the market-technology binomial is the most favourable to each company.
- To promote industrial quality, investment in design and product differentiation leading to improved productivity and increased competitiveness.
- To modify the salary structure, to reduce set costs and introduce productivity gauging on payrolls.

CONSIDERATIONS ON TECHNOLOGICAL DEVELOPMENT IN SPAIN
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