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Study of the costs of non Europe in Defence procurement The case of France

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Summary : The French doctrine was labelled as deterrence from the weak to the strong («dissuasion du faible au fort»). Then, French arms production is very important for both the national economy and technological development. For France, we analyzed the demand for defence equipment, the procurement system, the pricing procedures, the supply of defence equipment, the defence industrial base, , the co-operations on military equipment, the turnover of the main suppliers of the Ministry of defence and the main armament firms.,

La doctrine française est appelée " dissuasion du faible au fort ". La production d'armes française est très importante pour l'économie nationale et le développement technologique. Pour la France, nous avons analysé la demande de matériel de défense, le système d'approvisionnement, les procédures de fixation des prix, la fourniture de matériel de défense, la base industrielle de défense, les coopérations en matière de matériel militaire, le chiffre d'affaires des principaux fournisseurs du ministère de la défense et des principales entreprises françaises d'armement.

Armament industry, French arms firms, defense procurement, arms trade
Industrie d'armement, firmes d'armement françaises, achat de s biens militaires, commerce des armes.

INTRODUCTION

Defence costs have always been the subject of theoretical and political debates. Just as in the petroleum industry the armament industry is a special activity closely connected to international relations. Since the industrial revolution economists have classified military activities as unproductive expenditure. The idea that armaments constitute a waste of world resources seemed self-evident. However, if States want to possess weapons for their own security the impact of the military effort on their national economies will vary depending on their structures, their level of development, their openness to the outside world, etc. In the United Kingdom the arms industry has often been seen as having a negative effect on economic growth. Military projects have been seen as a very ineffective form of economic intervention damaging UK economic performance. In France, however, arms production is presented as one of the most efficient sectors for domestic economic development. Although there remain disagreements about the implementation of military planning or the distribution of the sums committed among the various types of weapons, the French political parties are not basically in doubt about the strategy of deterrence and the fundamental utility of an independent military industry.

This is an historic view too. With the introduction of firearms in the fourteenth century, the French government assumed monopolistic control over the production of powder and arms production fell under gradual State control. Colbert created arsenals at Rochefort and Toulon, developed the foundries at Strasbourg, Douai and Lyon and began the search for arms standardization which became effective by the end of the eighteenth century for the production of heavy equipment. After the fall of the crown, the Comite de Salut Public created hundreds of arms enterprises under state direction in order to eliminate potential internal subversions. By the end of 1794 France was producing more than 750 muskets a day, more than the rest of Europe. With the Industrial Revolution France's armaments industry experienced a crisis through the gradual superiority of Prussian arms.

In 1885 the Third Republic decided to create a modern arms industry and private enterprises; (supposedly motivated by profits and patriotism) obtained priority for the first time over State arsenals for economic and technological reasons of efficiency. By 1914 the quality and quantity of French arms production was similar to those of Germany. France was able to obtain leadership in aircraft production and to equip the American expeditionary army.

After 1918 the French arms industry declined with peacetime and a defensive strategy which relaxed demands on the arms production system was adopted. With German rearmament in the 1930s this policy was re-examined and the Front Populaire decided to nationalize selected private firms engaged in producing arms.

The defeat and the German occupation of French territory decimated domestic arms industries. The Fourth Republic, at the end of the war, tried to reconstitute and renovate French arms production in the general effort to develop French industry and to support colonial wars (from Indochina to Algeria). Arsenal and shipyards were gradually rebuilt and the aircraft industry was reorganised in 1949, with the first military jet aircraft sold to the French air forces (Ouragan 450 produced by Dassault, which was purchased by India and Israel). Armoured vehicles, missiles, helicopters, aircrafts became gradually very competitive on international markets and the decision to produce nuclear weapons confirmed the French will to develop a large and powerful arms industry. An Atomic Energy Commission was established in 1946, legally for civilian uses, but very early military nuclear uses were analyzed.

Under the Fifth Republic, the government changed three main characteristics of the Defence system; the development of a national nuclear force, the removal of French armies from the integrated military organization of NATO and the development of French arms production.

1) At the end of the colonial wars and the beginning of the Fifth Republic, the French Parliament reluctantly accepted the development of a national nuclear force. This was given the warlike denomination "*force de frappe*" rather than the strategic politically more acceptable name of "*force de dissuasion*". The French doctrine was labelled as "*dissuasion du faible au fort*".

2) French armies left the integrated military organization (NATO) to promote an independent military policy which became possible with the national nuclear forces. But France extended the field of intervention of its "*Force d'Action Rapide*" (Rapid Task Force) to the whole territory of the Federal Republic of Germany, even envisaging a possible nuclear cover of this country. The "*pre-strategic*" weapons (since 1992 their French name is ANUA, "Armes Nucléaires d'Ultime Avertissement") were not to be used on the battlefield but should be used as an ultimate warning to the enemy at the beginning of the nuclear process.

3) French arms production became very important for the national economy and for technological development. Consequently, French governments became involved in this development and two main decisions increased both the will of the State to develop the arms industry for strategic and economic reasons and the usefulness of a control over time of the production, in order to prepare the future. Created in 1961, the Délégation Ministérielle à l'Armement (D.M.A.), then the Délégation General pour l'Armement (DGA) centralized and co-ordinated the complex sprawl of manufacturing, research and development centres concerned with arms production. The Lois de Programmation were very useful in preparing for the future and improving the conditions for the independence of French arms production. For Kolodziej (1983), "these documents establish arms production goals and detail the financial arrangements to support targeted levels of production. Each year the production schedule and appropriations are updated to take account of a variety of factors, including economic conditions, price changes, availability of raw materials, employment problems and technological and scientific developments."(1)

TABLE 1: THE FRENCH "FORCE DE DISSUASION"

First, there are three constituent parts of the French deterrence nuclear forces : Mirage IV bombers, Plateau d'Albion GLBMs and Redoutable-class and Inflexible-class nuclear submarines with SLBMs. Second, there are the tactical forces (later named "pré-stratégique") then ANUA (Armes Nucléaires d'Ultime Avertissement) to underline their governmental nature and the renewal of conventional forces.
<p>Now, the French Strategic forces include :</p> <ul style="list-style-type: none"> - five nuclear-powered ballistic missile-armed submarines (SSBN), four with 16 missiles multiple 6 MSBS. One is being transformed from MSBS M20 warheads to MSBS M4 warheads. - 2 flights of Mirage IV bombers with medium-range air-to-ground nuclear charged missiles, - 18 silo-based missiles located on the Plateau d'Action, with S.3 warheads. - A logistic support of eleven KC 135 tanker aircrafts, four Transall aircrafts, sixteen training aircrafts (1 Mystère Falcon and 8 Mirage IIIB, 5 Mirage IV, 2 Alpha jets). - Three AWACS for the alert network system..
<p>The ANUA forces comprise :</p> <ul style="list-style-type: none"> - 24 Pluton 112 miles range rockets (soon replaced by Hades missiles 280 miles range missiles), - 38 Super-Etendard fighter-bombers with ASMP missiles for the Navy and - five flights for air forces (two with 30 Jaguars, equipped with AN 52 weapons and three with 45 Mirage 2000 N equipped with ASMP).

In France, the traditional activity in mechanics or metallurgy was produced by state arsenals. Aerospace and electronics were (and are) developed by industry and nuclear technology was (and is) controlled by the State (2).

After the Algerian war France gave priority to her capital expenditure, mainly in order to develop her nuclear deterrent. From 1968 onwards, this trend was reversed principally on account of the re-evaluation of military conditions. From 1978 onwards, in the face of new strategic situations, the modernization of the army equipment became a priority in spite of the not inconsiderable delays that were being experienced compared with the objectives of military planning. French capital military expenditures are very important, more than 50 % of the total military budget.

France imports few arms, between 1 to 5 % of the total according to USACDA estimate. However these figures are misleading because they do not take into account equipment manufactured collaboratively, or arms manufactures under licence⁽³⁾, or imported components necessary for the manufacture or assembly of arms. For every 10 francs worth of armaments exported, induced imports amount to more than 3 francs. Not only is the State the only customer of the armament industry on the domestic market, promoted and controlled by *Délégation Générale pour l'Armement (DGA)*, it also controls exports. DGA buys weapons for the The Ministry of Defence.

A: THE DEMAND FOR DEFENCE EQUIPMENT IN FRANCE

(i) General Trends in French Defence Expenditure

Before outlining the main trends in French defence spending one caveat must be made about data. The main tables of this report are based on the "Rapports Parlementaires". Usually, none of these Parliamentary Reports publish the tables in full. It is therefore very difficult to give all the data sources for each table, except when one of these Parliamentary Reports publishes a table in full.

We can see from Tables 2 and 3 that there was a significant increase in French military expenditure between 1970 and 1991 but that this growth has slowed markedly in the last five years. Overall we can say that expenditure increased 45% for the 1970 to 1990 period and that defence spending is set to increase in real terms in 1990-1991. This increase is despite the clamour for major cuts in military expenditure as a result of disarmament.

The consequence is that since 1970 defence spending has consistently remained above 3% of GDP (Table 4). Within this spending total the shares to each of the three services has been fairly constant, although the naval budget has been rising relative to

the other two services. Despite the high level of commitment to defence there has, however, been a relative decline in the share of defence spending in government expenditure (Table 5).

TABLE 2: ANNUAL DEFENCE CREDITS OF PAYMENTS TOTAL AND BY EACH SERVICE) (in billion current francs) (WITHOUT PENSIONS)

Years	Army	Navy	Air force	Joint Section	Defence spending
1970	7.87	4.72	6.04	6.75	27.19
1971	8.30	5.22	6.27	7.06	28.86
1972	8.01	5.54	6.71	8.31	31.23
1973	9.20	6.10	7.28	9.18	34.80
1974	10.27	6.42	8.03	10.01	38.22
1975	11.69	7.11	8.89	12.11	43.79
1976	13.76	7.93	10.06	13.51	50.00
1977	15.96	9.69	11.59	15.55	58.41
1978	18.62	11.80	14.04	17.54	67.65
1979	21.31	13.60	18.90	19.49	77.11
1980	24.37	15.82	18.98	22.19	88.60
1981	28.36	19.20	22.81	26.00	104.44
1982	31.66	23.01	26.86	29.80	122.86
1983	35.78	24.81	29.32	32.90	133.22
1984	38.37	25.97	30.17	34.20	142.10
1985	40.20	27.80	31.80	36.40	150.20
1986	42.30	29.60	33.40	38.45	158.40
1987	45.10	31.80	35.70	41.54	169.20
1988	45.50	33.30	35.90	44.19	174.28
1989	47.70	35.60	38.10	44.97	182.36
1990	49.00	37.51	39.52	45.89	189.44
1991	50.01	38.44	40.28	47.71	194.55
1992	50.87	38.63	40.37	46.88	195.27

Source: Rapports Parlementaires

TABLE 3: ANNUAL DEFENCE SPENDING - total and by each Service (army, navy, air force).

Credits of Payments (without pensions in billion constant francs 1990)

Years	Army	Navy	Air force	Joint Section	Military spending
1970	33.30	25.28	26.63	29.63	127.69
1985	46.83	32.27	36.81	42.13	174.98
1986	48.08	33.57	37.88	43.60	179.63
1987	49.61	39.27	39.27	44.10	186.12
1988	48.73	35.66	38.45	47.33	186.68
1989	49.32	36.81	39.40	46.50	188.60
1990	49.00	37.51	39.52	45.89	189.40
1991	47.11	36.55	36.94	44.86	182.95

Source: Rapports Parlementaires

**TABLE 4: SHARE OF DEFENCE SPENDING IN NATIONAL OUTPUT
(without pensions) (1970-1991)**

Years	Initial military budget/ Initial State budget	Initial military budget/ GDP
1958	27.0	6.00
1959	28.2	5.90
1960	28.5	5.58
1961	26.8	5.20
1962	24.7	4.79
1963	23.9	4.59
1964	23.0	4.41
1965	22.5	4.30
1966	21.8	4.21
1967	20.7	4.17
1968	20.1	4.07
1969	17.8	3.76
1970	17.6	3.47
1971	17.9	3.31
1972	17.7	3.17
1973	17.7	3.12
1974	17.4	2.99
1975	16.9	3.02
1976	17.1	2.98
1977	17.4	3.10
1978	16.9	3.16
1979	16.8	3.16
1980	16.9	3.30
1981	16.9	3.36
1982	15.6	3.46
1983	15.1	3.42
1984	15.2	3.39
1985	15.1	3.32
1986	15.4	3.24
1987	16.1	3.28
1988	16.1	3.17
1989	15.8	3.15
1990	15.6	3.11
1991	15.4	3.09
1992 (e)	15.0	3.00

Source: Rapports Parlementaires, SIRPA, CEDSI. (e) estimate

TABLE 5: SHARE OF DEFENCE SPENDING (PENSIONS INCLUDED) IN NATIONAL AND GOVERNMENT OUTPUT

Years	D/Y	D/G
1985	3.87	18.3
1986	3.87	18.9
1987	3.90	17.8
1988	3.76	18.6
1989	3.63	19.2
1990	3.56	18.6
1991	3.37	18.4
1992 (e)	3.26	18.0

D = military budget (pensions excluded) Y = Market Gross Domestic Production
DP = military budget (pensions included) G = Total budget

Source: for Defense Spending "Verts budgetaires" and for National output; INSEE
"Les Comptes de La Nation" (Yearbook). (e) estimate

TABLE 6: BREAKDOWN OF TOTAL DEFENCE EXPENDITURE
(million ECU)

Expenditures	1988	1989	1990	1991
Personnel	8.223	8.434	8.925	9.466
Maintenance	6.390	6.696	7.031	7.216
Procurement	6.514	6.929	7.058	7.028
R&D	3.641	3.893	4.449	4.312
Total	24,768	25,952	27,463	28,022

Despite the high level of commitment to defence there has been a relative decline in the share of defence spending in national output and in Government output.

(ii) Defence Equipment and R&D Spending in France

In so far as the overall shape of equipment spending is concerned it is clear that the French government has reduced its nuclear effort in favour of conventional and infrastructure developments since 1980. French military equipment includes the five "budgetary sections", namely Army, Navy, Air Forces, Gendarmerie (which is a very special French force) and the Common Section (especially the nuclear forces). It includes:

- Nuclear studies, development and productions.
- Space studies, development and productions,
- Conventional studies and development
- Conventional weapons,
- Ammunitions,
- Personnel maintenance,
- Equipment maintenance,
- Infrastructure

TABLE 7: FRENCH CAPITAL MILITARY EXPENDITURE (%)

Forces	1988	1989	1990	1991
Nuclear forces	33.6	32.2	31.4	30.1
Space	1.5	2.0	2.9	3.0
Conventional equipment	29.2	28.8	27.3	28.3
Conventional studies & development	14.3	14.3	15.7	16.2
Munitions	7.3	7.5	7.4	5.6
Maintenance equipment	6.2	6.2	6.7	7/9
Personnel maintenance	2.2	2.1	2.0	2.0
Infrastructure	5.7	6.3	6.6	6.9

Source: Rapports Parlementaires

TABLE 8: CAPITAL EXPENDITURE DEVOTED TO FRENCH NUCLEAR FORCES (in million of current francs)

Years	Strategic nuclear forces	Tactical nuclear forces	Total
1980	11850	730	12580
1981	13730	870	14600
1982	16190	740	16830
1983	17830	1470	19300
1984	19300	2440	21740
1985	30214	3172	23386
1986	20967	4301	25268
1987	21759	6039	27798
1988	23651	6895	30546
1989	24785	6743	31528
1990	25847	6241	32089
1991	25753	5313	31066
1992	25614	4432	30046

Source: Rapports Parlementaires.

TABLE 9: THE COST OF THE "DETERRENCE FORCES" (billion current francs)

Years	"Deterrence Forces" costs (FPC in billion current francs)	FPC/Military budget	FPC/GDP
de Gaulle			
1960	0.54	3.25	0.21
1961	0.91	5.22	0.31
1962	1.25	6.98	0.38
1963	2.43	12.48	0.67
1964	3.70	18.77	0.92
1965	5.04	24.16	1.17
1966	5.57	25.31	1.19
1967	6.28	26.41	1.23
1968	6.27	24.59	1.15
1969	5.37	20.57	0.86
Pompidou			
1970	5.09	18.48	0.73
1971	5.08	17.37	0.65
1972	5.09	16.05	0.58
1973	5.52	15.70	0.55
1974	6.22	15.74	0.55
Giscard d'Estaing			
1975	6.41	13.88	0.50
1976	7.02	13.42	0.48
1977	7.96	13.58	0.50
1978	9.27	13.58	0.50
1979	10.86	14.08	0.51
1980	12.42	14.02	0.52
1981	14.86	14.20	0.54
Mitterrand			
1982	17.75	14.38	0.58
1983	19.30	14.54	0.56
1984	21.74	15.30	0.59
1985	23.39	15.57	0.60
1986	25.27	15.95	0.60
1987	27.80	16.43	0.63
1988	30.55	17.52	0.65
1989	31.53	17.29	0.64
1990	32.09	16.93	0.63
1991	31.07	15.97	0.59

Source: Jacques Percebois (1985), Jacques Fontanel (1989) and Rapports Parlementaires.

The figures below indicate that the structure of the military equipment spending by forces is fairly stable. There has been a recent increase for the navy with a compensating cut in army spending. It is clear from a close analysis of French equipment orders that the French state has historically sustained its independent national defence system by purchasing all other major weapons systems for each of the three armed services, and for the gendarmerie. The total number of orders and deliveries for the major equipment programmes between 1987 and 1991 are presented in Tables 12 and 13. Table 14 provides an overview of the main weapon systems currently in use by the French armed services. Tables 15, 16 and 17 indicate the types of systems purchased in detail since 1987.

TABLE 10: EQUIPMENT SPENDING BY FORCES (billion of current French Francs

Years	Army	Sea	Air	Joint Section	Total
1985	17.2	15.2	17.7	18.90	71.7
1986	18.6	16.5	19.1	20.24	75.7
1987	20.9	18.6	21.8	23.00	85.8
1988	21.0	20.0	22.1	26.01	90.8
1989	22.7	22.6	24.2	26.75	98.0
1990	23.5	24.0	25.0	27.62	102.1
1991	23.1	24.9	25.3	27.82	103.1
1992	23.6	24.8	25.2	27.22	102.9

Source: SIRPA "La défense en chiffres" (Yearbook)

TABLE 11: EQUIPMENT SPENDING BY FORCES (billion constant 1990 French Francs

Years	Army	Sea	Air	Joint Section	Total
1985	20.04	17.71	20.62	21.84	83.53
1986	21.09	18.71	21.66	22.94	85.84
1987	22.99	20.46	23.98	25.30	94.38
1988	22.49	21.42	23.67	27.86	97.25
1989	23.47	23.37	25.02	27.66	101.33
1990	23.50	24.00	25.00	27.62	102.10
1991	23.61	23.50	24.46	26.64	101.10

Source: SIRPA: "La Défense en chiffres" (Yearbook).

TABLE 12: ORDERS FOR THE MAIN FRENCH EQUIPMENT PROGRAMMES (1987-1991)

Equipment	1987	1988	1989	1990	1991
Land					
Char AMX 30 B2	64	75	46	0	0
Char Leclerc			16	10	12
V.B.I.	105	180	284	100	0
V.A.B.	255	255	255	220	0
E.B.G.	18	18	16	0	0
PFM	35	34	46		
Tactical vehicles	2678	3227	3230	1762	101
155 canons	26	61	57	37	
L.R.M.	4	6	17	17	12
Gazelle-Hot	15	15			
Super-Puma	6	8	8		
Air					
Mirage 2000 DA	23	17	12	10;	
Mirage 2000N	12	8	6		
Mirage 2000 N' and D	0	10	15	18	18
Mirage F1	0	0	0	22(R)	
SDA AWACS	4				
Hercules C130	6	4			
Light Helicopters	6	6			
SATCP Systems and crotales	80	180	110		
Super 530 missile and Magic II missile	110	150	310	510	100
Sea					
BAMO		3			1
Observation frigate			2	2	
Attack Nuclear Submarines			1		
Atlantique 2	5	6	5	3	3
Torpedoes (L.5 F 17)	9				
Murene torpedoes			30		
SM 39 missiles	11	11	7	11	11
MM 40 missiles	16	8			6
Nuclear					
M4 reconstruction	1				
SNLE-NG	1		1		

Source: Rapports parlementaires

Notes: (R) = Renovation

TABLE 13 - DELIVERIES OF THE MAIN FRENCH EQUIPMENT PROGRAMMES (1987-1991)

Equipment	1987	1988	1989	1990	1991
Army					
AMX 30 B2 tank	70	75	67	77	58
Leclerc tank					1
V.B.L.	12	12	25	9	160
V.A.B.	268	253	255	253	208
E.B.G.	0	8	12	19	22
PFM	34	46	46		
Tactical vehicles	2614	3873	3418	2727	1865
155 canons	24	18	59		21
L.R.M.				9	14
Gazelle-Hot	16	15	11		
Super-Puma	1	5	6		
Air					
Mirage 2000 DA	8	17	16	19	18
Mirage 2000 N	11	16	17		
Mirage 2000 N' (then D)				13	8
Mirage F1	1				
SDA AWACS				1	3
C130 Hercules	3	3	4		
Epsilon	33	24	4		
Light helicopters	6	9			
SATCP+Crotales systems	118	69	165		
Super 530 missiles and	55	195	315	220	130
Magic II missile	150				
Sea					
ASM frigates	1			1	
AA Frigate		1			1
S.N.A.	1	1			1
Atlantique 2			1	4	4
Torpedoes (L5 F17)		20	51		
SM 39 missiles	10	19	9	7	
MM40 missiles	23	9	5	16	10
Nuclear					
M4 reconstruction	1				

Source: Rapports parlementaires

Tables 14 and 15 provide details of the total number of military systems in use in 199 and the main programmes under the "loi de Programmation Militaire".

TABLE 14 - MAIN FRENCH MILITARY EQUIPMENT IN 1990

1) Fighter aircrafts		
Air Forces : 845		
with : Mirage F1 :	207	
Mirage III and 5F	152	
Mirage IV	20	
Mirage 2000	151	
Jaguar	156	
Alphajet	159	
Navy : 108		
with Super Etendard	38	
Crusader	8	
Etendard	8	
Alizé	27	
Atlantic	27	
2) Transport aircrafts		
Air Forces	153	
Navy	52	
Army	10	
3) Helicopters		
Air Forces	135	
Navy	96	
Army	704	
4) Tanks		
MBT AMX 30	1340	
Light tanks (AMX 10 RC)	326	
(AMX 13)	143	
5) Armoured fighting vehicles		
VAB	3523	
VAB HOT	135	
ERC Sagaie	147	
VTT	174	
AMX 10/PC	817	
AMT	588	
6) Warships		
Submarines SSBN	6	
Tactical SSN	4	
Tactical SS	9	
Aircraft carriers	2	
Cruiser	1	
Destroyers	4	
Frigates	34	
Patrol and coastal combatants	24	
Mines (warfare) and (countermeasure)	23	
Amphibious	9	
Support and miscellaneous	33	

Source : IISS "Military balance" and SIRPA : "La défense en chiffres".

TABLE 15 MAIN PROGRAMMES IN THE FRENCH "LOI DE PROGRAMMATION MILITAIRE"(1987-1991)

Programs	Imputation	% equipment effort
Mirage 2000 DA	Conventional, Air	4.7
SNLE N.G.	Nuclear Navy	4.3
Mirage 2000 N	Nuclear Air	3.0
M.4.	Nuclear, Common section	2.9
Atlantic N.G.	Conventional Navy	2.3
Tactic vehicle	Conventional Land	1.7
SNLE improvement	Nuclear Navy	1.7
Cannon 155	Conventional, Land	1.7
Hadès	Nuclear, Common Section	1.6
S4	Nuclear, common section	1.4
AMX 30 B2	Conventional Land	1.3
S.D.A.	Conventional Air	1.2
Aircraft carrier	Conventional, Navy	1.1
ACT	Conventional, Air	1.1
SNA	Conventional Navy	1.0
LRM	Conventional, Land	0.9
Syracuse	Space, Common section	0.8
HAC/HAP	Conventional, Land	0.8
AMX Leclerc	Conventional, Land	0.8
ASMP	Nuclear, Common Section	0.7
Hélios	Space, Conventional	0.6

Source: Compiled from Fillon, Francois (1987), p. 73.

TABLE 16: MAIN LONG TERM FRENCH EQUIPMENT MILITARY PROGRAMMES (in billion francs) IN THE LAW (1987-1992)

Programmes	Total costs	Number	Delivery date
Nuclear			
-Missiles M4	37.00	80	1987-1993
-Nuclear submarines rebuilding	14.50	5	1987-1993
-Missiles M5	73.00	96	1999
-SNLE-NG (Le Triomphant en 1994)	65.00	6	1994-2007
-S4 Albion	30.00	36	1996
ASMP	6.70	90	1988-1991
-Mirage 2000 N	30.13	60	1988-1991
-(Astarté-Ramses) Hades	13.60		1988-1996
Space			
-Hélios	6.60	2	1993-1995
-Syracuse II	4.00	2	1992-1995
Army			
-AMX 30B2	12.00	680	1987-1991
-Char Leclerc	45.00 ⁽¹⁾	1100	1992
-HAC-HAP		215	1997
-Canon 155	19.00	500	1992-1994
-LRM (developed with USA and four European countries)	16.40	45	1989-1994
-Orchidée (abandoned in 1991)	6.00		1996
-Tactical and Logistical Vehicles	8.25	17500	1987-1992
Air			
-Mirage 2000 DA and N'	63.00	225	1988-1992
-Light cargos	1.97	25	1992
-AWACS	7.75	4	1991-1996
-ACT Rafale	142.00	250	1998
Sea			
-Nuclear Aircraft Carrier	13.90	1	1996-2001
-SNLE (Foudroyant)			1993
-SNA (Améthyste in 1991)	14.00	8	1982-1997
-Light frigate	16.00	10	1994-2000
-Supervision frigate	2.40	6	
-BAMO (anti mines)		10	1992-2000
-Crusader modernisation	1.15	20	1993-1996
-ACM Rafale		86	
-Atlantique	26.30	42	1990
-Helico NH 90		60	1998-2008
Gendarmerie			
-Terminaux Saphir		15300	1987-1991
-Réseau Rubis	2.0	22000	1993-1997

Source: Fillon (1987)

(1) This programme has now been reduced to less than 1000 - probably 800.

TABLE 17 - MAIN MILITARY EQUIPMENT PROGRAMMES IN 1991

Development Murene (torpedo), now M.U.90.
Observation frigate (Floréal)
Anti-mine ship (narvik)
Modernization sna 6th and 7th, the 8th is cancelled and the 7th is postponed.
Modernization frigates (Tourville)
Construction of aircraft carrier Charles de Gaulle
Frigates (la Fayette)
Maritime Patrol Aircraft (Atlantique 2)
Super Etendard Modernization
Crusader modernization
Le triomphant (strategic nuclear submarine)
SNLE NGno 2
Reconstruction "Le Foudroyant"
Delivery of 18 mirage 2000D
210 air-to-air missiles
Helicopter NH 90
8 Mirage 2000 D (delivery)
Orders of 700 air-to-surface bombs
130 air-to-air missiles
160 surface-to-air short range missiles
Delivery of 1003 air-to-surface bombs
Hadès programme
Development Ramsés
12 AMX Leclerc
12 multiple rockets launchers
55 SATCP Mistral (surface-to-air short range)
1550 tactical vehicles
330 logistic transport vehicles
105 major armoured vehicles
2 Helicopters Dauphin
Delivery of 5 Helicopters 'Ecureuil'
Améthyste modernization
Delivery of hydrographic ship "Arago"

Sources: SIRPA: "La défense en chiffres, 1991. Monory, René, "Rapport de la Commission des Finances/Défenses en capital (Sénat, Doc No 92, Annexe P.V. du 19/11/1991, Tome III, Annexe 47).

The main characteristics of French R&D expenditure are:

- In the computer sector, military leadership is declining and civil product are now more complex than military products. Military computer R&D is sometimes important for development, but not for fundamental research.
- The civil spin-off of military naval R&D is now very small except for composite materials and very rarely in electronic equipment.
- The relations between military and civil aeronautic products are very ambiguous. Because of the dual applications of these products. But it is very difficult for a country to build an aerospace sector without military purchases.

- There is little spin-off from nuclear weapons programmes which could profit the civilian nuclear industry because results are so secret that access is not permitted for civilians.
- Military R&D represents more than 15 per cent of the military budget, a third of the R&D State budget and more than a fifth of the national effort in R&D. In 1988, more than 24 billion francs went to private or public industrial enterprises for military R&D. In 1989, DGA will entrust 60 per cent of its military research to enterprises, 15 per cent to the universities and 25 per cent to itself. For Aerospatiale, R&D outlays represent 23% of turnover and the military programme, entirely financed by public funds, financed 75 per cent of the total R&D. More than 20,000 highly skilled workers are employed by the MoD (mainly by DGA) in military R&D, but this figure seems very low in comparison with international data.
- Military products are voracious of R&D funds and especially of electronics (50 per cent of the new Leclerc tank is devoted to electronics). Actually, R&D represents 30 per cent of the price of military products and this percentage is clearly growing as indicated in Tables 18 and 19.

TABLE 18: STATE DEFENCE R&D (in billion current francs)

Years	State Defence R&D	% Public Budget R&D
1976	5.05	28.3
1977	5.95	29.2
1978	7.55	32.4
1979	9.35	34.3
1980	11.35	35.7
1981	17.67	39.0
1982	17.86	35.5
1983	20.31	33.7
1984	22.98	33.2
1985	23.62	31.5
1986	25.78	34.7
1987	30.75	38.3
1988	32.40	36.5
1989	33.70	36.1
1990	36.60	37.1

Source: "Vets budgétaires" and "Rapport Annexe sur l'état de la recherche et du développement technologique ("jaune budgétaire").

TABLE 19: MILITARY R&D IN 1990 AND 1991 (in billion francs)

Sections	1990	1991
Common Section	23.44	23.26
Air	5.80	7.05
Army	4.14	3.23
Navy	3.28	3.34
Total	36.57	36.88

Source: "Vets budgétaires".

Some analysts argue that military R&D has significant spin-offs for the civilian sector and that research in the military field yields civilian applications as a by-product (radar, computers, electronics for example). Spin-offs are also used as an argument for European participation in the Strategic Defence Initiative (SDI) developed by the government of the United States. In this version, SDI would produce goods directly useful to the civilian sector and would be the occasion to obtain insight into modern U.S. technology. The other school of thought considers that spin-offs are weak. For example, integrated circuit or silicon chips were developed by commercial firms mainly with civilian funding. If early development such as radar, jet engine or transport aircraft or more recently semiconductors, fiber optics, lasers, nuclear power, satellite communications and composite materials are presented as successful technology transfers these efforts to stimulate development and expand markets represent quite limited contributions, taking into account the importance of civil transfers to military products. The growing importance of new materials, lasers, advances energy devices and computers will inevitable lead to a growing overlap of defence and non-defence technologies.

The economic role of R&D is not the same in every country. The United States is very proud of its high technology and it seeks a lot of new directions for research. France has discovered what the best avenues for research are, and has tried to finance only the most promising innovations so as not to waste R&D resources only a few technical possibilities are tested. But, ever since the post-war reconstruction period, France's relative weakness in exploiting the results of R&D and its relative slowness in applying new technology in the economy have been apparent. Too often new technology costs money in France but earns money elsewhere. Although most analysts have failed to find evidence of a direct productivity impact from State R&D expenditures, they nevertheless consider that public R&D may have a considerable indirect impact (positive or negative) on total factor productivity if it influences private R&D investment decisions. There are three main hypotheses : the crowding-out, spillover and demand-pull effects.

- **The crowding-out effect** is predicated on the assumption that military and civil R&D employ similar types of resources, such as engineers, scientists or equipment. In the USA, it has been proved that federal R&D spending had a determinant influence on the starting salaries of engineers and scientists. In France, no study exists on this hypothesis. But, when military and public R&D become a main State objective, then government can try to attract highly skilled manpower and, in doing, so improve the wage rates of graduating scientists and engineers in the short run, even though the

supply of graduates is much more elastic in the long run. In France, State R&D personnel are sometimes public servants; so that, if higher wage rates are perhaps an incentive, it is not always possible to raise them because of public servant status. It is easier to increase operations and maintenance, procurement and construction than to increase salaries, except for indirect and non-cumulative payments such as bounties or special subsidies. The crowding-out effects may occur when very specialized engineers are requisitioned by military sectors, thus provoking bottlenecks for civil production or when limited financial resources are allocated directly to arms production. In France, these effects certainly exist, but it is not obvious that they are very important, taking account of the high degree of complementarity between military and civilian R&D in the present structure of defence in France.

- **The spillovers of military R&D** generate knowledge which can be cheaply or costlessly exploited by civilian R&D and which increase the productivity of the civil sector. The larger the stock of knowledge-capital, the smaller the quantity of civil R&D needed to produce marginal improvements in products and processes. But, it is possible that in some instances the value of the spillover is negative, when the applications of military technologies, such as the Concorde for example, have been a financial disaster for public utilities, their customers and the citizens. For five or six years the French governments have been trying to develop spillovers. The study of Schankermman and Pakes on the value of patent rights in the U.K., France and the FRG during the post-1950 period indicates that there is a dense concentration of patent rights with very little value. The general picture of a sharply skewed distribution of the value of patent rights emerges clearly in all three countries. Basic research certainly offers the greatest prospects for generating beneficial knowledge. Because of secrecy and the highly classified nature of much public-supported activity, the special development of hardware and the differences between military and civil types of thinking, there is very little potential for the commercialization of military R&D.

- **The demand-pull effects** can result in the demand for technology producing innovation. Military R&D stresses the role of market and production opportunity in innovation. It is often difficult to know if there really is a demand-pull effect (short run theory) or a technology-push effect (long run theory, which insists on the role of supply factors in explaining variation in research activity). Because of the "*military-industrial complex*", it seems that in France the technology-push effect in military R&D is predominant.

B: THE DEFENCE PROCUREMENT SYSTEM IN FRANCE

(i) The Formal Institutional Structure

At the top of the French arms industry is the DGA (General Direction for Armament), created in 1961, which is a technical service within the Ministry of Defence with the task of co-ordinating the manufacturing, research and development centers concerned with arms design, testing and production. The General Staffs indicate the main military characteristics of the equipment, the number of units to be produced and the time scales required. DGA defines technical characteristics, implementation procedures, negotiation of prices with enterprises and control of production factories. The operational responsibility of the General Staffs is of a different nature than that of DGA, which is technical and industrial. The functions of direction and supervision occupy up to 25,000 people. Since 1988, there has been a "*Conseil général pour l'armement*" which advises the Ministry of Defence on the question of scientific progress, scientific and engineer training and other armaments issues. The Délégué général pour l'armement makes proposals to the Minister and controls the implementation of decisions and, is also responsible for armaments industrial policy.

DPAG :	Direction des Personnels et Affaires Générales
DPA:	Délégué aux Programmes d'Armement
DRI:	Délégué aux Relations Internationales
SCAI:	Service Central des Affaires Industrielles
SSIA:	Service de Surveillance Industrielle de l'Armement
DRET :	Direction des Recherches, études et techniques
DAT :	Direction des armements terrestres
DCN :	Direction des constructions navales
DCAé :	Direction des constructions aéronautiques
DME:	Direction des Missiles et de l'Espace

DIAGRAM 1: FRENCH DEFENCE ORGANIZATION

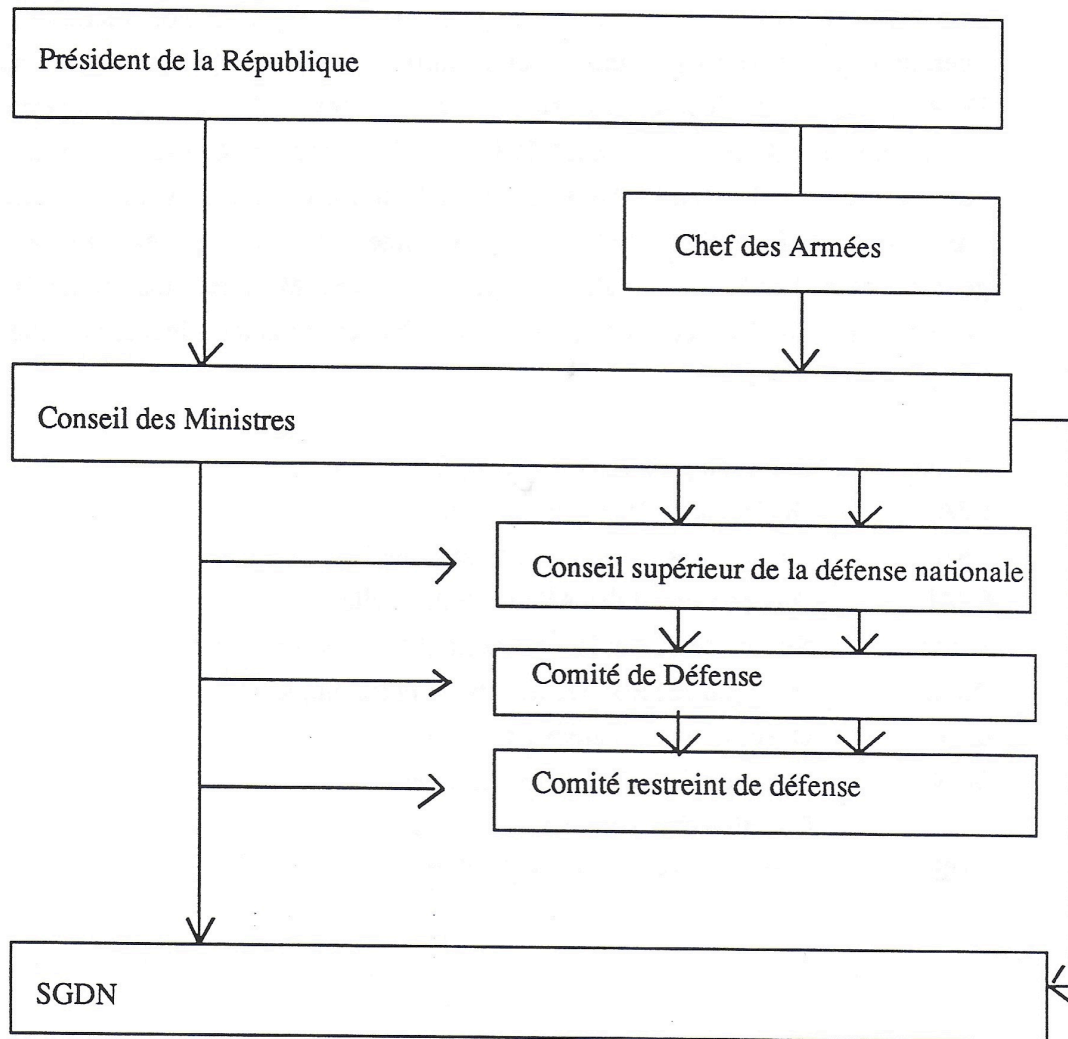
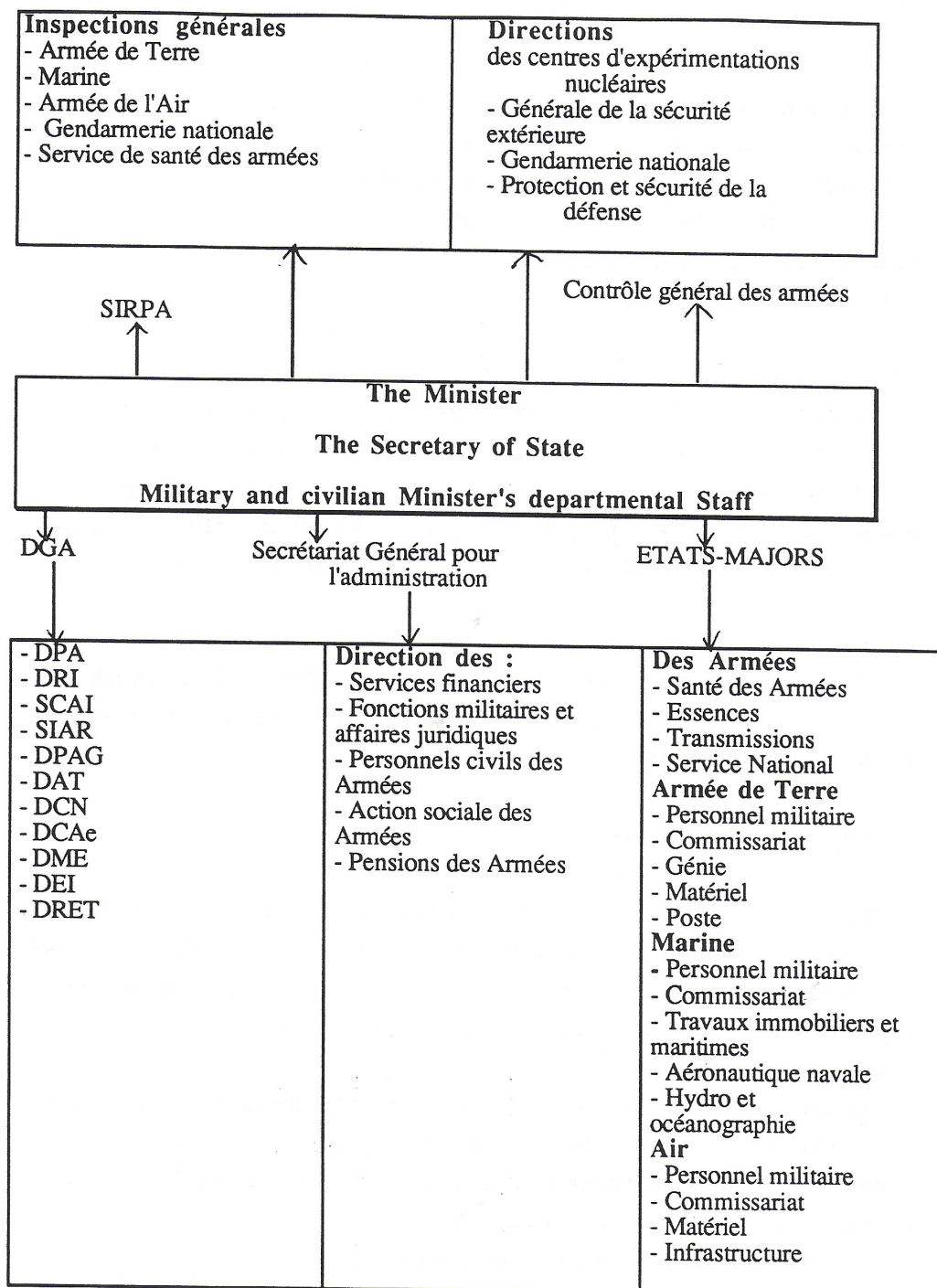


DIAGRAM 2 - FRENCH DEFENCE MINISTRY ORGANIZATION



The next stage in the process is the Budgetary Choice Rationalization (Rationalisation des choix budgétaires or RCB), where the Government specifies the rules. There are six stages:

- Presentation of the mission and definition of efficiency,
- Operational description of proposed systems,
- Establishment of an efficiency and applications model,
- Establishment of costs and applications models,
- Sensitivity studies and results analysis,
- Conclusions and propositions.

The definition of missions and systems implies the description of the nature of means, the technical characteristics, the materials performances, the personnel needs, the unit organisations and their connections. The methods evaluation requires an efficiency model with data and hypothesis on the basis of the model and the logical and mathematical relations for simulations. The costs model includes analyses of the total functional cost, the forecast costs, the financial costs and the marginal cost.

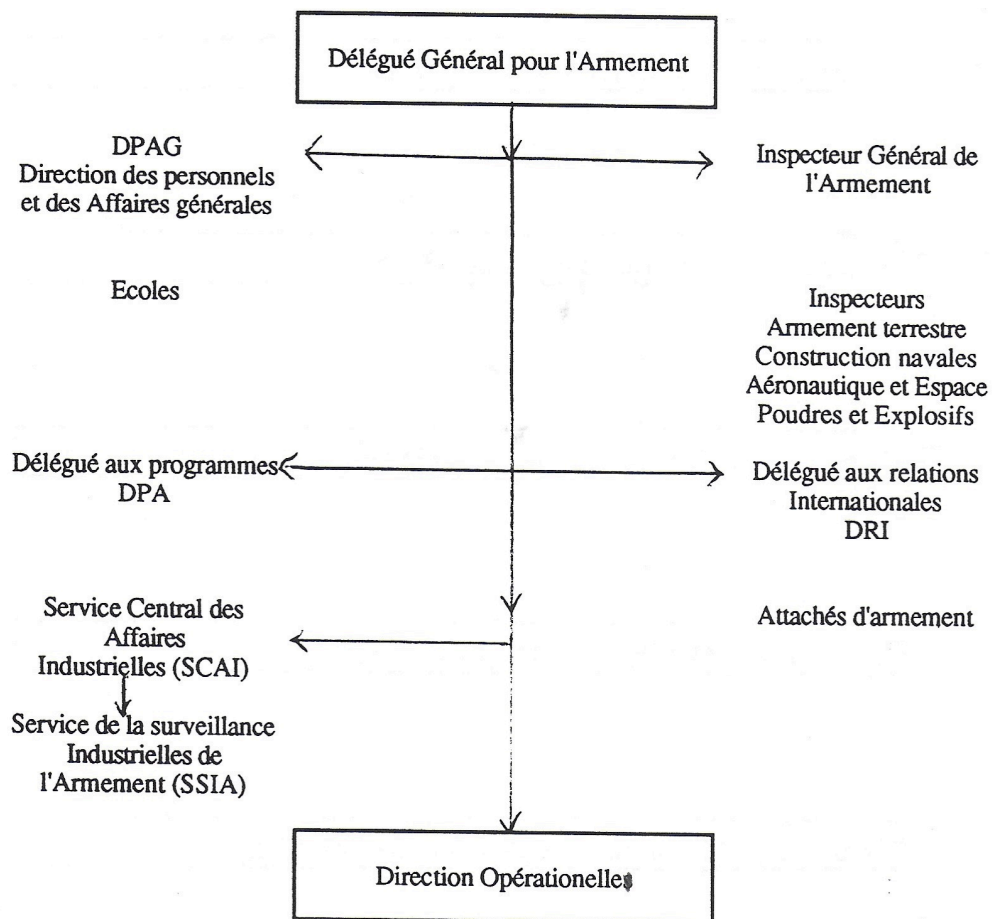
There is also a long-term Plan which tries to define the fundamental objectives of defence. The medium-term Plan (loi de programmation militaire - 5 years) establishes the objectives, in terms of budget and units for the major weapons, for the future equipment of the armed forces.

DGA has three fields of action :

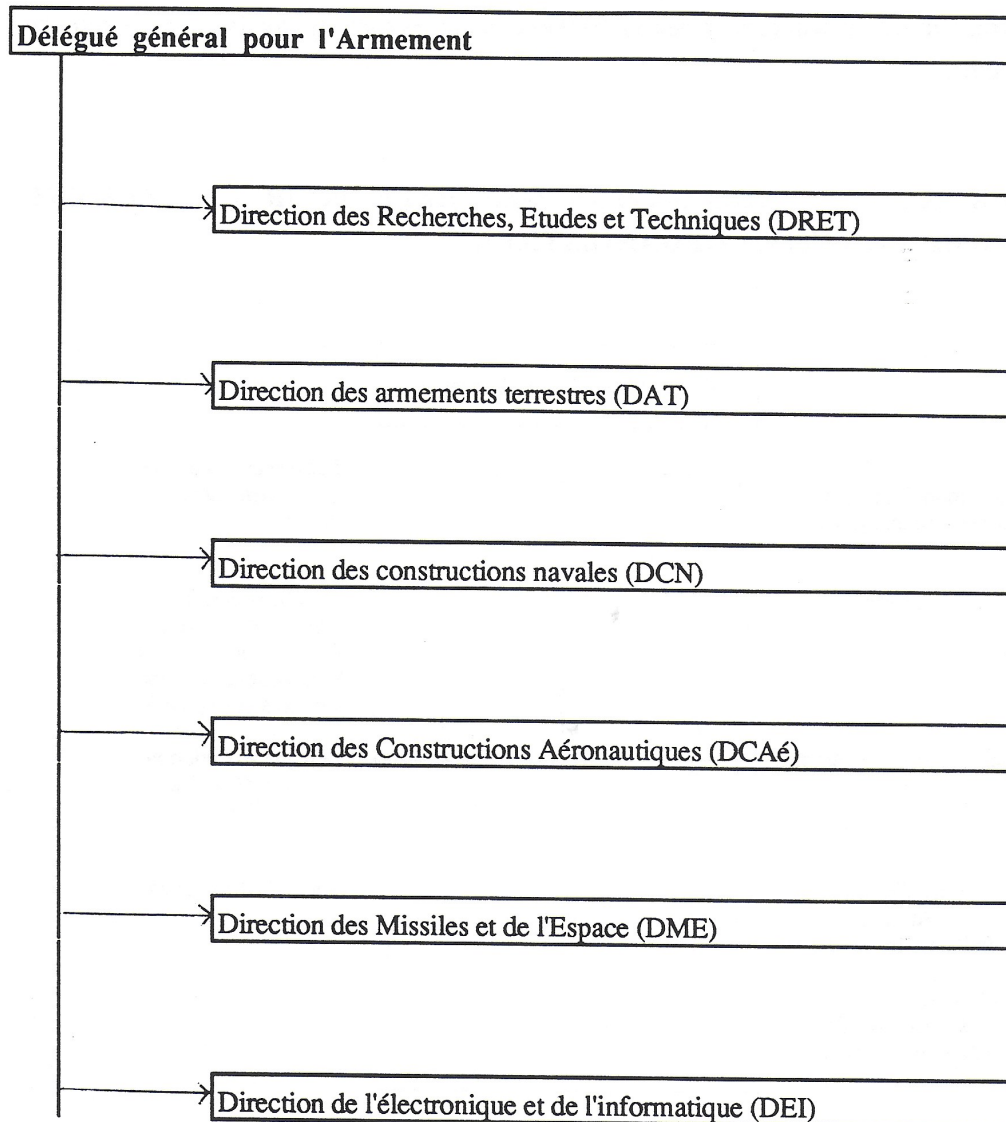
- First, it is an interface between the armed forces and the arms industry. It oversees the arms industry. The relations between managers of the arms industry, DGA personnel and military staff are very close, because they are largely composed of military engineers, with the same training and education, who have the opportunity of working in the armaments industry.
- Second, it is heavily engaged in arms production, with the direction of the arsenal and shipbuilding complex, responsible for the direction of the military part of output in co-operation with firms producing civilian and military goods and the control of enterprises dealing with armament production.
- Third, it supports and controls international co-operation and armament exports.

The Délégation Générale pour l'Armement (DGA) is responsible for all French arms programmes, from the beginning (R&D) to the end (production and maintenance). Through the "Directions de programmes", it is in charge of establishing technical specifications, negotiating contracts with industry and monitoring the carrying out of programmes. It works with nearly 10,000 companies directly involved in the defence sector.

**DIAGRAM 3: DÉLÉGATION GÉNÉRALE POUR L'ARMEMENT
(ADMINISTRATIVE ORGANIZATION)**



**DIAGRAM 4: DÉLÉGATION GÉNÉRALE POUR L'ARMEMENT
(OPERATIONAL TASKS)**



The role of DGA differs according to the specific industrial sector concerned. For the aeronautic and space sectors its main role is to be an intermediary between the Air General Staff and enterprises. For the naval sectors it has a larger responsibility for production itself. The implementation of an armament contract is a very long process, which begins with the product concept and continues to mass production. The programme notion takes the place of the market. DGA, by the attribution of research contracts and "*maîtrise d'oeuvre*" (with price negotiations, control of production units, or definition of technical characteristics), is able to improve technological specialization and, hopefully, restructuring. It can control and support exports, giving the enterprises useful orders in order to ensure financial equilibrium. It is a main actor in the arms production system. DGA is responsible for the Arsenal and shipbuilding complex. It has centres throughout France, although not in the northeast and northwest because of repeated invasions in these regions.

(ii) The Defence Procurement Process and Equipment Choices

There are five phases in equipment choices :⁽⁴⁾

- expression of needs.
- feasibility.
- definition (the study of the solutions agreed, with an explanation of performances, delays and costs).
- development (the material conception phase, with evaluation, quantification and experimentation).
- production (with industrialization and fabrication).

When two national companies are competing the choice between them depends on technical and economical performance, and sometimes on macroeconomic concerns for the national production system⁽⁵⁾. Often, the responsible "Directors of Programmes" in DGA will negotiate the sharing of the project with a leader (for the radar of Rafale, Thomson-CSF had to give a third of the total work to its main rival Electronique Serge Dassault). When a programme is commenced it is very difficult to stop it; although the government can modify this decision.

There are a large number of monopolies in the French armament industry :

DASSAULT-AVIATION for fighter aircraft,

AEROSPATIALE for helicopters and ballistic missiles,
DCN for warships,
GIAT-Industries for caterpillar armoured vehicles,
SNECMA for aircraft engines,
SNPE for powder and explosives,
THOMSON-CSF for radar detection systems
THOMSON-BRANDT ARMAMENT for mortars.

In these circumstances DGA's choice is limited to choosing between national or co-operative production or imports. Price competitiveness considerations are larger than when national competition alone is being considered. When it is competition between two or three French companies (Aérospatiale and Matra for some tactical engines, RVI and Panhard for wheeled armoured vehicles) economic and price considerations are not always paramount.

Very few industrially advanced countries are in a position to convert notions of national security into comprehensive programmes covering all possible paths of technological development. Often technology dictates policy instead of serving it. The second basic question is to know exactly what financial burden the nation is prepared to accept for what defence. It is essential to consider defence costs in relation to the optimum methods of defence and a given budget level. There is in practice a constant interaction between costs and budget, which largely depends on the cost of existing or future hardware. The "*Lois de Programmation*" try to provide prospective answers to those questions. The contents of the French "*Lois de Programmation*" have varied. From 1960 to 1977, only the equipment programme (Titre V) was included. Officially, it was not "*Lois de Programmation*", but "*Lois de Programme*" introducing the interesting idea that the law was not applicable to defence expenditure as a whole.

The Fourth "*Loi de Programmation*" introduced total military expenditures, in payment allocations ; it gave some resources guarantees with a relation between the budget and the Tradeable Gross Domestic Production and an intermediate Government report on the execution and the immediate future of the Programmation. The Fifth law, incorrectly named "*Loi de Programmation*", does not include operational costs. There are three levels in the government time schedule : the Plan for the long run (between 15 and 20 years), the "*Programme*" for the middle run (5 years) and the budget for the short run (one year). The *Lois de Programmation* co-ordinates the decision-making process from the Plan to the Budget final act.

The "*Programmation Militaire*" (military programme for five years) put forward in 1987 seemed to satisfy everyone and defence has ceased, except for the Communist Party, to be a subject of discord. The Socialists have indeed approved the last "*Loi de Programmation*" which was adopted by the Parliament during Spring 1987 with a large majority (536 votes for and only 37 against, especially from the Communist Party, at the French Assemblée Nationale). France has not really been marked by a general questioning of the objectives of defence policy. Parliamentary debates have been focused on the proportion of GDP that should be devoted to defence, on the application of long-term plans and on long-term credibility of the deterrent forces.

The future plans outlined in the *programmation militaire* 1987-1991 are not yet very explicit, although there is talk of increasing capital expenditure, especially nuclear, in order to continue fitting out missile-launching nuclear submarines (with the M-4 system), to strengthen the communication and command systems of nuclear forces, to construct a new generation of missile-launching nuclear submarines, to develop a new ballistic missile (M-5), to build a nuclear aircraft-carrier and to introduce the Hades tactical weapons system. The "*Loi de Programmation*" is very important for military industries, because domestic demand was 65, 73 and 77 billion francs in 1986, 1987 and 1988 respectively and it has historically compensated for general reductions in exports.

TABLE 20: THE FRENCH MILITARY "LOIS DE PROGRAMMATION"

Dates	Registered resource	Number of programmes	Observations
1960-1964	A third of "Programmes authorizations"	16	- Current francs - Nuclear Forces priority - No payment allocations registered
1965-1970	Two third of Programmes authorizations"	25	- Current francs - Nuclear Forces priority - No payment allocations registered
1971-1975	The totality of Programmes authorizations"	31	- Current francs - Nuclear Forces priority - No payment allocations registered
1976	-	-	
1977-1982	Totality of payment allocations	39	- Precise equipment law - Payment allocations for operational costs
1983	-		-
1984-1988	Totality of payment allocations	40	- Global presentation Not year by year - Main financial effort for the end of the period
1987-1991	Payment allocations for equipment only	27	- Revolving plan for 1989 1990, 1991. - Constant francs
1990-1993	Payment allocations for equipment only		- Revolving plan for 1992 and 1993 - Constant francs

TABLE 21: PAYMENT ALLOCATIONS FROM "LOI DE PROGRAMMATION (in billion francs 1986)

Years allocations	Payment allocations Law 87-91 (francs 86)	Payment Law 90-93 (francs 90)
1987	84.127	
1988	89.100	
1989	94.450	
1990	100.120	103.100
1991	106.200	107.200

Source: Rapports Parlementaires, Fillon (1987) and Boucheron, J.M. (AN 2/10/1989) Doc No. 897.

Nuclear deterrence is a highly centralized process, making use, in the last resort, of the highest authority in the state and, at intermediate levels, of specialists trained in secrecy and discipline. Though there is a consensus about the deterrent forces, it is none the less true that the choices between conventional forces and nuclear forces have not yet reached a critical stage in their development. The cost of nuclear deterrence is very low in comparison with its strategic advantages for a medium power like France. Since 1970, changes have occurred slowly and smoothly. If France has given priority to strategic nuclear forces, it should be emphasized that the structure of its expenditure does not make nuclear weapons a financial priority, since the direct costs of the nuclear forces represent only a fifth of total military expenditure (this figure is very high in comparison with UK figures which are usually lower than 6 per cent of total military expenditures).

The modernization of France's strategic nuclear strike force can be achieved easily, because of the relatively small percentage of GDP devoted to defence and the possibility of temporarily holding conventional forces as they are. In 1986, France spent no more than 21 billion francs (1981 value) on its new conventional weapons, nearly three times less than the United Kingdom. Despite this it is probable that France has had to limit her ambitions as regards conventional weapons and, the pursuit of the nuclear strategy will be accompanied by further painful financial choices in the future.

There are four main problems : the difficulty of maintaining the current levels of military expenditures, the forecast of inflation rate, the introduction, in the forecasts, of new international events (such as a disarmament process or the emergence of new weapons), and the achievement of planned objectives.

- From 1960 to 1983, five "*lois de programmation militaire*" were voted by the Parliament, with the aim of gradually covering the whole of military expenditure. The

inefficiency of military programming was proclaimed by some Members of Parliament. Each new programme was designed to make up for the gaps of the preceding one and to avoid new delays, but this was not usually possible. With the sixth law, this idea appeared too ambitious and it was decided again to programme only equipment expenditures.

- With the US Strategic Defence Initiative and the US-Soviet agreement on Intermediate range Nuclear Forces (INF) in Europe, the government will have to face a new strategic challenge and the consensus that surrounds nuclear deterrence may be threatened. While it is useful to recall that no French long run defence programmes has ever been fully implemented without political conflict, the new technological challenges in the military sector seem to be particularly dangerous for the consensus on defence in France. The supply of military equipment must be obtained by foreign purchases when French industry is not really competitive, arms exports have to be developed and a collaboration on arms production with the FRG is being encouraged.

- The main problem faced by the French "*Loi de Programmation*" was inflation forecasting. For the period 1960-1983 inflation was constant, at an average rate as high as 7 % par year, with a maximum at 15 % in 1974. Although in France it is not established that military inflation is not higher than general inflation, such rates are easily able to destroy the purchasing power of any budget. Moreover as public budgets are adapting themselves to inflation and because they are often the instrument of anti-inflation policies, inflation rates were almost systematically underestimated and the adjustments rarely managed to balance current expenditure with the new growth in prices. Another problem concerns the specific prices of armaments systems, which not only undergo price increases, due to the civilian price indices, but also the additional costs of new sophisticated technical progress. The history of French military programming is littered with examples of uncompleted armament programmes due to inadequate forecasting of prices : Plateau d'Albion GLBMs, Pluton SRBMs.

- Even though it is a law, the "*Loi de Programmation*" is not binding for the Government. It is only guideline planning, which decides the main programmes for the next five years. In comparison with the programmed resources decided in 1987, the budgetary allocations are below target. The "*Loi de Programmation*" law is not really a law, but a solemn declaration of intention and not a juridical act ; as opposed to a Programme authorization, it does not allow to anyone to sign contract or to pay for expenditure. Some programmes included in the Programmation law were not carried out and sometimes other programmes, which were not foreseen by the law, were

developed, as the Hélios project. However, this law is very important, because it outlines the future strategy of the State for its own security.

The conception, design and implementation of an armaments decision takes a very long time (often more than ten years) and it is not always possible to introduce the same procurement procedures on a regular basis. There are also a wide number of contracts which may require differential treatment.

- Research contracts and conventions (not always connected to a material product) but concerned with basic research.
- Research contracts which study a concept with a known end in order to see whether it is potentially applicable to military purposes.
- Study contracts into implementation, (such as the fabrication of a "*maquette*"), without involving actual production.
- Prototype contracts which involve the construction of one or more prototypes for testing and, if possible, preparing for mass production.
- Industrial process contracts which ensure the financial statement of investments for armament production.

For all of these contracts the State services supervise armament industrial contracts inside the factories. The State technical services control the evolution and the progression of the suppliers' work. Manufacturing quality and the checking specifications are important routine procedures, in relation with the users services. There exists a legal possibility for the purchasers to give some service orders to the suppliers, but in armament relations the State and the enterprises prefer the use of an additional judicial act, which allows the continuation of the work, without waiting for the final decision. For study contracts, the relations between suppliers and buyers have the character of an information exchange.

The industrial market involves technical specifications which are part of the contract and there is a guarantee contract which does not exceed six months or one year. This is why the characteristics checking of quality, performance, materials and, manufacturing process is so important, in order to define the industrial responsibility in case of malfunction. The operational specifications are given by a General Staff document, which lays down the main components. The technical specifications involve the required results, the description of methods in order to obtain the results and the technical specifications applicable to the methods. The State services must be very competent to ensure the observations of the contractual conditions. Some penalties

should be applied for delays, but it is often impossible to apply them, because of the close relations between the enterprises and the State. At present, the French government prefers having a regular and specialized supplier, in order to optimize national resources in engineers, research bureau organizations and productive investments. It takes 7 to 10 years for the conception and the production of an aircraft engine. Thus, the Government must have a long run relation with the enterprise and, because national demand is quite limited, it prefers to create some controlled monopolies in order to give sufficient orders to these enterprises. The State has final control of the armament industry, because it guides R&D and it is the main buyer. In these circumstances, it can be argued that it is not so important for it to be the main owner of the armament firms.

Parliament votes both the military budget and the "*Loi de Programmation militaire*". The main part of verification and controls are made by La Délégation Générale de l'Armement, which is producer, consumer and auditor. There is a continual process of checking samples of prices and costs by DGA, but this data is secret and not available to Parliament. These samples provide useful indicators of prices, but it is very difficult for DGA to modify eventual existing distortions because its control is based on chronological data. Parliament votes the Defence budget, but it is not responsible for the Defence policy. The Fifth Republic institutionalized the casting role of the Executive on Diplomatic and Defence policies. The Parliament usually has to approve the actions of the Président de la République and of the Government. The Parliament is able to have an influence, such as by harassing the government by procedural acts or by using financial power or legal controls. On arms purchases, the Parliament can use financial and control actions, but it is not involved in the contract procedures themselves. There exists the possibility of a "*Commission d'enquête*", but it is not very easy to use it for a regular control.

The "*Cour des Comptes*" reports give some information previously published by "la commission de vérification des comptes des entreprises publiques". But it has very large responsibilities and the armaments industry is only a small part of its competence.

Created in 1966, the CPRFA, "*Comité des prix de revient des fabrications d'armement*" (composed of representatives of Parliament, Etats-Majors, DGA, Cour des Comptes, inspection des finances, contrôleurs des prix), has to examine the military equipment cost prices of the State companies or public and private producers in the armaments orders. It has to compare the prices paid by the State and the cost prices of the enterprises, and the differences between forecasted and real prices. CPRFA published 17 reports, but with a very poor diffusion and the interest of its work is reduced by its

own poor instruments of investigation. Since 1988, no report had been published. Sometimes, the Ministry can finance some reports (Rapport Engerrand on GIAT, or Rapport on the evolution of the price of Leclerc tank and Rafale aircraft). Finally, the "*Commissaires du gouvernement*" into 39 enterprises can be interesting but it is not easily available and it is difficult to assess the independence of their judgements.

Tender and Pricing Procedures

For the last few years, tender practices have been constant. There is an industrial armament firm with a national leadership or monopoly in each weapon system that might be purchased (Aérospatiale for helicopters, Dassault-aviation for aircrafts, Matra for missiles air-air, GIAT-industrie for tanks, SNECMA for aircraft engines, Turbomeca for helicopter turbines). For electronics, Thomson-CSF has a leading position. As a result, there has been a tendency for strong protection of the French arms industry; for strategic (nuclear deterrence, independence of the national defence needs) and economic reasons (the economic importance of the enterprises involved in arms industry). This has been achieved by introducing various informal and formal barriers to protect the domestic arms industry and, if it is useful for the national interest, to pay above world market price for domestic weapons. The competitiveness of any proposed French arms product is therefore difficult to access. The normal structure for choosing between suppliers is quite simple. When the French Ministry of Defence needs major weapons it usually prefers a French industrial solution if national enterprises are able to produce a suitable product, with a relatively competitive price. There is a very clear national preference, but now the game is more complex with the necessity of European cooperation. While this has led to the Anglo-French agreement and support for the IEPG programme for industrial, strategic and political reasons a clear national preference exists. The Anglo-French agreement while significant politically only amounts to 250 million francs in total commercial exchange.

The decision about who wins the contract is often the result of internal negotiations in the military structure. Here the central role is played by DGA, which tries to solve the conflicts of interest between armament enterprises on a project. DGA chooses between suppliers, taking account of their nationality, the consequences for regions or national industries and sometimes their prices when it is not a major weapon proposal. There are juridical tender rules for contractors, but DGA buys its weapons, without precise justification. The national security argument can be used. Controlled expenditure contracts, where the price is determined retrospectively on the basis of accounting cost

plus a profit margin, is the most common procedure when the sums involved are considerable and uncertain. Competition between arms firms has moved away from simple competition for the sale of a product to competition for research contracts or programmes for arms that complement or replace other arms. In general, for strategic weapons, there is no competition. For conventional weapons competition is the rule, although this is often limited to domestic suppliers, wherever possible. There are also many areas where this is not possible domestically because of monopoly. For non-military equipment open tendering applies, as in the civil sector.

The DGA finances the development of hardware and guarantees a market. The existence of DGA often eliminates the contractor's risk. The question is whether national arms production is still justified. National economic self-sufficiency and independence in arms is usually the goal of DGA policy but this can prove both expensive and dangerous due to a limited domestic market. This leads to a search for outside outlets on which industry then becomes dependent. There is also inadequate productivity in the space and aeronautics industry compared with US plants and the diversion of industrial efforts in all types of arms. Usually, for major weapons where there are a large number of potential national suppliers, the contract is given to one enterprise (a "maître d'oeuvre"), but this leader is instructed to subcontract to other national competitors. The percentages of contracts awarded by open, restricted and negotiated procedures are not available but some discussions of the degree of openness is provided later. Nuclear and space equipments are not bought in the market, as is the case for aircraft where a national monopoly or a European-French programme exists. France does not operate civilian GATT rules for public supply contracts in defence dual use goods.

There are three broad categories of military products for which contracts are awarded:

- goods destined only for the defence market (nuclear warheads) or markets reduced by military secrecy (sonar equipment),
- common products with significant differences between defence and civilian markets (aeroengines) and
- dual use products which are identical or nearly identical (memory chips).

The military spin off to civilian innovation increases with the similarity of products and markets. The present trend seems to be to develop completely specialised and sometimes unique goods (without any economies of scale) and so military conversions to civilian applications are rare, thus reducing the efficiency of the military sector for

national economic development. But the components of products are not so different. Since 1980, military products have used more and more civil components, such as electronics. Military goods are constantly changing in quality over time. This means that the cost structure of military items constantly changes from one period to another.

The prices of military hardware do not therefore reflect the influence of a competitive market and they very often relate to a project under development rather than an immediately available product. There are two main situations :

- *Controlled Expenditure Contracts* where the price is determined retrospectively on the basis of accounting cost-plus a profit margin,

- *Fixed-Price Contracts* in which the prices are fixed from the outset.

The *Controlled Expenditure Contract* is more common when there is some technical uncertainty. The government undertakes to reimburse the contractor for all the costs associated with the project plus an additional amount, fixed either as a percentage mark-up or as a fee irrespective of costs. This first contract is less difficult to sign for the armament enterprises, because the contractor can accept easily a doubling of costs because his mark-up increases accordingly. This method of fixing contracts shows the secondary place of prices in the purchase decision. The measurement of military expenditure price changes presents some special problems: the timing of the price decision, long-term contracts, transportation charges and the introduction of new technology. Military output without a market price or without adequate market pricing occurs frequently. If there is a price, it may not include all costs. Usually, less than a third of the contracts are let using the controlled expenditure procedure. The "Service des enquêtes des coûts de l'armement" is in charge of cost auditing and price investigations for all contracts.

The *Fixed Price Contract* has the advantage that, once the price is agreed upon the industrial pressure is on the supplier to meet his commitments without raising costs. The fixed prices are either market prices - if there is a market - or negotiated prices. The latter is the most common case for the majority of major weapons contracts. The system of "prix plafond" (price to be agreed with a ceiling) is applied if it is not possible to determine a fixed-price from the beginning. The armament enterprise is then responsible for its own inefficiencies, poor performance or delays. The main economic risk is on the industrial firm, but the government will be involved if the contractor is unable to produce the products. This type of contract is not often used,

although it puts pressure on the contractor to limit costs in order to preserve the rate of profit on turnover. It is more valuable when the military goods are standardised or when the estimates of price are reckoned to be rather good. If the government wants to use "fixed price contracts", they are, however, often obliged to use the "controlled expenditure" procedure. This is the case for fuel, clothing or food, but usually the contractors insist on some additional agreement above fixed prices for inflation or price changes of inputs outside of their control. Moreover, it is not uncommon for fixed-price contracts to undergo significant price changes, either because the consumer wants the initial project to be modified or because of unforeseeable factors which call into question the continuation of the project. Development costs are notoriously difficult to control, even in a commercial environment. The DGA has set up a body of price auditors but their practical usefulness has sometimes been questioned mainly by the Cour des Comptes. The contracts are a priori controlled by the interministerial "Commission Centrale des Marchés" and can be "a posteriori" controlled by the "Cour des Comptes". Usually, the government prefers "fixed price contracts". But this type of contract is very difficult to apply for production which is time consuming (such as very large arms systems) or which is not standardized, (such as high technological military products). If the French government wants to apply "fixed price contracts" in order to avoid wasting of money they are obliged to use "controlled expenditure contracts".

The system of *"Price to be agreed" Contracts* which allow work to begin before a complete agreement gives more flexibility to contracts which take time to complete. The preliminary work is started on the basis of a possible price to be set within an agreed time. Then, by an iterative negotiation, depending mainly on the experience in manufacturing the item, prices are settled, usually on a fixed-price arrangement. Since it is costs which establish and control prices, performance criteria mainly depend on the efficiency of the industrial sectors directly or indirectly connected to the arms industry. A major influence on the unit cost of weapons is the scale of production. There have been numerous cases in France where costs have overshoot forecasts but they have not often been the subject of public debate. It must be said that military secrecy is more developed in France than in the Scandinavian or Anglo-Saxon countries. Arms firms are, for the most part, nationalized ; they have a high degree of monopoly in their own production sector, and they are dependent on a price formation system that reduces risks but also reduces their essential economic dynamism.

Often, costs do get out of control, but such cases are not affected by direct competition or by any limits to the desire to obtain the government contract at all costs. Overshoots

are due to cumbersome bureaucratic management, sometimes seeking to prolong a contract as an additional source of activity during a period of economic recession, to research or technological difficulties which are partly the State's responsibility, to the modification of the project during its execution, or to the risks inherent in any industrial activity. Normally, military products tend to have high costs because of the importance of the research and development element, which is about 30 per cent of the cost of military aeronautical products, compared with 4 per cent of the cost of a car, because of poor economies of scale (doubling the sales of an aircraft would reduce its cost by only 10 per cent on average which is certainly less than the economies likely to be achieved by strict management of the project) and because of the narrowly specified nature of arms production equipment.

TABLE 22: TYPES OF PRICE CONTRACTS (6)

Controlled expenditures contracts	
-	study of radar Aquitaine
-	Some parts of missile MALAFON
-	Development of missile MAGIC 550
-	Study and development of propellant RITA 2
Ceiling contract price	
-	Fabrication of radar Aquitaine
-	Study and industrialisation of helicopter PUMA SA330
-	Fabrication of the two first investment of PUMA SA330
Price subject to modification contract	
-	Studies and prototypes of strategic bomber MIRAGE IV
-	Development of the cell of aircraft JAGUAR
-	Fabrication of missile MAGIC 550
-	Parts of engine M53
-	Development of aircraft engine JAGUAR
-	Supplies of propellant RITA 2
-	Development of aircraft MIRAGE 2000
Targets prices contracts	
-	Fabrication of strategic bomber MIRAGE IV
Temporary prices contracts	
-	Parts of missile MALAFON
-	Fabrication of vehicles SIMCA-MARMON
-	Maintenance of tanks AMX 10
Price control (en régie) contract	
-	Engines of JAGUAR
-	Parts of engine M53.
"Enveloppe" procedure	
-	Aircraft SUPER-ETENDARD

Source: Comité des prix de Revient des fabrications d'armement

Note: These contracts were largely awarded before 1980.

The ceiling contract prices and the controlled expenditures contracts are the most usual, with a new preference for the former.

The main recent developments in contracting awards and tendering have been that since 1980 the armament industry has become more and more involved in the payment of R&D. In the 1970s, the State had completely assumed financial responsibilities, except for Exocet and contracts financed by export consumers advances, like Saudi Arabia. Relatedly, international co-operation has become more important and there has been an awareness of the need to consider the industrial consequences of possible cuts in defence orders.

This latter development is essential because not only is the State the only customer of the armaments industry in the domestic market, it also controls exports. The armaments market is a monopsony. Competition tends to be eroded by the action of the DGA. Through the awards of study contracts and the supervision of major programmes, the DGA has promoted the existence of "*bilateral monopolies*", i.e. the presence, in each market, of a single buyer and a highly specialized single seller. In fact, competition has moved away from simple competition for the sale of a product to competition for research contracts or programmes for arms that complement or replace other arms. DGA finances the development of hardware and guarantees a market, especially as it exerts the main influence on the requirements defined by the General Staffs and on the sale of military hardware abroad, which it controls through the Direction des Affaires Internationales. The existence of the DGA tends to eliminate the contractor's risk and it is not usual for the latter to commit himself to a programme without having received prior financing from the state. However, the government's own armaments factories are in latent crisis and they criticize the state for a policy that favours private companies, which reduces their own market correspondingly. In 1990, 75 % and 90 % of total French armament turnover was accounted for by the ten and by the twenty-five top enterprises, respectively.

Competition is usually restricted to two or three companies : Aérospatiale and Matra for some tactical engines, RVI and Panhard for wheeled armoured vehicles. There are monopolies : Dassault-Aviation for fighter aircraft, Aérospatiale for helicopters and ballistic missiles, DCN for warships, GIAT industries for caterpillar armoured vehicles, SNECMA for aircraft engines, SNPE for powder and explosives, Thomson-CSF for radar detection systems, Thomson-Brandt Armement for mortars. For the Rafale radar, two competitive proposals were developed by Dassault Electronique (with Westinghouse) and Thomson-CSF (with Texas Instruments). DGA decided to give the leadership to a GIE (Groupement d'Intérêt Economique) with two-thirds for TABLE

23: THE MAIN PRODUCTION OF THE MAJOR FRENCH ARMAMENT ENTERPRISES

Enterprises	Products
Aérospatiale	Transall, Epsilon, Gazelle, Dauphin, Puma, Super-Puma Hot Milan, Roland, AS 15, AS 30, Exocet Pluton, Hadès, ASMP Surface-to-Surface missiles Sea-to-Surface missiles
(AMD.BA) Dassault Aviation	Mirage III, Mirage 5, Mirage 50 F1, Alphajet Super Etendard, Mirage F1, Mirage 2000 Atlantic 2 Rafale
CEA	Tactical and strategic nuclear loading Nuclear propelling
Sextant Avionique	Aeronautic and naval navigation system Army armaments
(ESD Dassault-Electronique)	Aeronautic electronic equipments
GIAT - Industries	Ordnance, artillery elements Ammunitions Armoured vehicles, tanks Light and medium weapons
(Luchaire) GIAT - Industries	Shells, grenades, missiles, rockets
(Matra-Manurhin-Défense)GIAT - Industries	Ammunition, light weapons, military engineering
Matra	Super S30 and Magic (Air-to-Air missiles) Mistral (Surface-Sea missiles) Otomat (Sea-to-Sea missiles) SATCP (Surface-to-Air missiles) Durandal (bombs) ASM Missiles Rubis system (communication Gendarmerie)
Panhard & Levassor (Peugeot)	Small armoured vehicles, land vehicles
Renault Vehicules Industriels	Tanks engines, armoured vehicles
SAGEM	Aeronautic and naval navigation, guidance and pilotage systems
SNECMA	Aircraft engines
SEP	Ballistic missiles and tactical engines liquid powder propelling
SNPE	Explosives, munitions, propelling
Thomson - CSF	Detections, arms systems Communications
Thomson-Brandt-Armements	Surface armament Aeronautic armament Ammunitions
T.R.T. (Télécommunications Radio-électriques et Téléphoniques)	Aeronautic equipment Optronic
Turboméca	Aeronautic turbine engines (helicopters)

Thomson-CSF and one-third for E.S.D. For the replacement of Crusaders on aircraft carriers, two main solutions existed, i.e. the purchase of the F18 (with positive advice from the Navy Staff) or the extension of the Crusaders, with some technical improvements. The solution was of political nature in favour of Crusaders, without any economic analysis or "*appels d'offres*" (solicitation of orders). There are therefore few openly competitive practices in the French defence procurement process.

While it is difficult to delineate what have been the major French defence contracts awarded between 1980 and 1991 (because it depends of the costs imputations of R&D and of the actualization rate) Table 24 gives a basic outline. One must be aware however that these are only a sample of the main contracts awarded by the French MoD and comprehensive conclusions cannot be drawn from this data.

TABLE 24: MAIN FRENCH DEFENCE CONTRACTS AWARDED (1985-1991)

-1	ACT Rafale
-2	Missiles M5
-3	SNLE Le Triomphant
-4	Mirage 2000 DA and D
-5	Leclerc Tank
-6	Missiles M4
-7	Mirage 2000 N
-8	S4 Albion
-9	Atlantique
-10	Canon 155
-11	LRM
-12	Light frigate
-13	Nuclear submarines rebuilding
-14	SNA "Améthyste"
-15	De Gaulle aircraft carriers
-16	Hades
-17	AWACS

France imports few arms, usually one to ten percent of the equipment bought each year according to US Arms Control and Disarmament Agency (USACDA). There has, however, been a significant growth in the last three years, with the imports of Airbus components⁽⁷⁾ and the purchases of AWACS, HERCULES C130 and light transport aircraft CASA. These figures are misleading, however, because they do not take into account equipment manufactured collaboratively, of arms manufactured under licence or imported components useful for the manufacture or assembly of arms. In fact, much of France's production is dependent on imports. For instance, armaments exported account for 30 per cent of components imports. There is some ambiguity about what distinguishes an import : whether the crucial characteristic is that it is made in France, made by a French-owned firm or made with French technology. In several sectors of

manufacturing, the products of foreign-owned companies are more French than the products of French-owned companies.

In contrast to the British NIMROD programme, which was a major failure, the purchase of four U.S. AWACS gives an interesting example of a successful import. The French obtained a good deal (7,35 billion vs 10 billion French francs originally forecasted) and French industry would have been unable to produce this kind of product at a competitive price. The choice between national production and imports is often very difficult to make. For instance, for the Rafale programme there are some questions which have not yet been resolved, particularly for the naval version. France will have a transition problem between 1994 and 2000. The renting of U.S. F18 aircraft was studied, but that solution was rejected on technical grounds (weight, radar signature, modernisation needs), on economic grounds (costly adaptation, large operating costs, cost duplications), on industrial grounds (with large investment for a temporary solution, the temptation will arise to maintain F18 against the naval version of Rafale and to replace Super-Etendard for the years 2000-2005), and on export grounds (sales arguments for US competitors of French military aircraft). Although there are some long run industrial compensations for a foreign solution for the transition period, this choice was rejected, for the time being at least.

The components of weapons systems are not always produced domestically. The Pentagon discovered recently that the high-tech electronics needed for its defence were made in Japan (80%) and for Europe the situation is worse. Thus, if electronic components are not exactly arms systems, it is undeniable that they ought to be included in the import of armaments. This analysis must be made not only for industrial components, but also for research, industrial property rights and the testing of results.

Compared with foreign countries, France does not appear to have high production costs. In particular, French military R & D costs seem far lower than those in the United States, Italy or the United Kingdom. Moreover, an exporting armaments industry is normally able to supply products at satisfactory prices for its own domestic market if it does not allow itself to be tempted by dumping or by selling at a price which only covers fixed costs. If a weapon is imported the buyer may gain part of the advantage accruing from the seller's longer production run. For short production runs there is little return in investing heavily in cost-reducing equipment and process innovation. Thus, the cost of a weapon is often reduced by imports, but the exceptional quality of the weapons, the absence of competition for technical or political reasons or the importance of international military supply may be the more important characteristics. Conversely, the foreign buyer sometimes pays for part of the research

expenditure, particularly when the product concerned is much in demand, when the arms market is not too saturated by competitive tenders or when the export contract is awarded even before the product concerned has been developed.

A further uncertainty is added to the costing when the equipment is imported: there may be fluctuations in the exchange rate, (although commercial firms have a wide variety of methods of hedging longer-term contracts against exchange rate risk). Arms import contracts tend to be complicated, involving offset deals, credit terms, counter-trade and many other elements. As a result the real price is difficult to estimate. The bargaining power of buyers and sellers will depend on the extent of the competition. If the equipment supplied by firms is very similar, or even identical, the buyer has scope to substitute and the price will be forced down. If the supplier is in a monopoly situation and the equipment is essential to the potential importer, then the price may be high. Currently, the arms export market is very competitive and many governments have subsidized the development of indigenous national industries for political and sometimes economic reasons. This creates strong pressures to export, with cheap credit for importers, and sometimes prices are forced down towards marginal production cost which is much less than average cost. In the past, arms exporting countries tried to obtain political advantages; now importing countries want low prices, without political implications.

(iii) Recent Developments in French Defence Procurement Policy

As France is not currently planning to undertake severe cuts in defence spending through to 1996. Despite this there is planning underway to reduce the level of commitments of the past and new objectives will be defined at the March 1992 session of the National Assembly. Table 25 gives some indication of recent plans. It is, however, no longer up to date because a new medium term plan will be presented to Parliament in mid-1992. It is expected that this will reveal a stagnation in future military expenditure in real terms.

TABLE 25: FUTURE FRENCH MILITARY EXPENDITURE

Years	Operating costs	Capital expenditures	Military expenditures (ME)	GDPm	ME/GDPm
1991	91.4	103.1	194.5	5770	3.37
1992	92.3	106.9	199.2	5920	3.36
1993	93.2	110.8	204	6074	3.36
1994	94.2	114.7	208.9	6230	3.35
1995	95.1	118.8	213.9	6390	3.35
1996	96.1	122.9	219	6560	3.34

Source: Rapports Parlementaires 1990.

Since 1989, the defence budget has been the most important expenditure item in the State budget, now it is education budget. Defence spending had been increasing yearly at a higher rate than inflation; despite this its share of the GNP decreased continuously from more than 4% in 1982 to less than 3.6% in 1991. The structure of French defence spending is constant, although the level of spending on the navy has shown a constant relative increase. Much of France's arms policy since 1979 has been aimed at reinforcing the credibility of the nuclear deterrence and more than 30 % of military expenditure allocated to equipment is regularly devoted to nuclear forces.

The French military budget is normally divided into two categories: current expenditure (Titre III) and equipment (Titre V). An increasing share has been attributed to equipment (Table 26). This was high in the 1960s (50% of the budget during the buildup of the nuclear forces) but has decreased somewhat since 1977. The 1990-1993 programme had stabilized this ratio. The Army has been the main loser in reduction in operating costs, with a loss of between 6000 and 7000 men in its personnel per year. But the technical effort for this Army has also been very high in order to improve the quality of conventional equipment. The share of military R&D has increased more rapidly than equipment expenditure since 1980.

TABLE 26: THE DEFENCE BUDGET SHARES ATTRIBUTED TO EQUIPMENT AND OPERATING EXPENDITURES

Years	Equipment expenditures	Operating expenditures
1975	43.42	56.58
1976	41.90	58.10
1977	41.01	58.99
1978	42.09	57.91
1979	43.24	56.76
1980	44.97	54.34
1981	45.66	54.34
1982	45.83	54.17
1983	45.98	54.02
1984	46.86	53.14
1985	48.76	51.24
1986	47.80	52.20
1987	50.72	49.28
1988	53.13	47.87
1989	53.74	46.26
1990	53.89	46.11
1991	53.02	46.98
1992	52.70	47.30

Other changes are likely to come in the future as the pressure for European co-operation increases. France had historically supported international cooperation policies.

Between 1959 and 1968, France played a pioneering role in European cooperation. It took the lead in the NATO maritime patrol aircraft Atlantic (with FRG, Netherlands, Italy). From 1959 to 1964, it developed five programmes with FRG (airlift Transall, artillery radar RATAC, anti-tank missiles Milan and Hot and the ground-to-air missile Roland). From 1964 to 1967, France cooperated with the UK on aeronautical programmes (missile Martel, the fighter Jaguar, the helicopters Gazelle and Lynx and a participation of UK in the Puma and Exocet programmes). From 1968, when the Eurogroup was created, France was no longer in NATO and this meant France could not participate. She therefore followed a new industrial strategy, based on exports. French contributions to international cooperation became more sporadic thereafter (trainer-support aircraft Alpha-jet with FRG and the minehunter Eridan with Belgium and Netherlands). France was gradually isolated, but supported the creation of the IEPG in 1976. In 1992, 50 % of the French aerospace industry turnover results from cooperative European programmes, but no cooperation has taken place so far on nuclear weapons. Since the 1980s there has been increasing activity on the part of France and Germany to see the development of a European defence identity (with the promotion of the WEU, the initiatives for a European policy of defence and security as part of the political union and the promotion of research programmes such as EUCLID in the IEPG (Independent European Programme Group)).

The EC's wider mandate to co-ordinate industrial policy in the field of high technology will necessarily affect arms production, because it is often impossible to distinguish military and civilian R&D and production. *"Increased Western Europeanization of seemingly civilian R&D in the wake of the creation of the single Market increases already strong pressures for a more coordinated framework on military R&D. Here several economic interests can be distinguished. First, we have national procurement agencies and politicians in charge of procurement, who expect lower prices from a more competitive arms market. Second, arms production companies see chances for economic gains from a more open arms market in Western Europe. Third, options for all parties involved are narrowing because of the increasing costs of weapon systems. Especially, in sectors like space, or electronic sit is argued, West European companies need a combined civilian-military approach in order to compete with the high-subsidized US and the high-civilian-subsidized Japanese competitors"*(8)

C: THE SUPPLY OF DEFENCE EQUIPMENT AND THE DEFENCE INDUSTRIAL BASE IN FRANCE

(i) The French Defence Industrial Base

The question of whether national arms production is justified is normally defended on the following grounds:

- a defence industrial base is fundamental for political and strategic reasons.
- the importance of military research is fundamental to the competitiveness of national R&D ;
- national industries need military orders in high-technology sectors (like computers and aeronautics) ;
- imports are subject to price fluctuations stemming in particular from erratic exchange rate variations (at a time when the value of the dollar was continually increasing, Sweden had to increase its defence budget, by a multiplier coefficient mainly determined by the exchange rate of the dollar, in order to satisfy its military planning) ;
- national production saves foreign currency and improves the balance of payments
- the arms manufactured meet the nation's defence requirements.

The main idea is to have a national champion in order to obtain scales economies and to develop subcontracting systems. With the restructuring of European industry, the French armament sector has had to change via industrial regroupings. This has not been official doctrine but pragmatism has ensured its fulfilment. Technological success is dependent upon educational systems, the volume and distribution of research and development investment and innovative orientations. Despite the emergence of new arms suppliers, the technological hierarchy of defense production remains in place. A reduction in R&D effort could have two additional effects : first, the French arms industry would lose its military competitiveness in the quality of weapons and so would abandon its markets ; second, military R&D would not be replaced by civil R&D and so there would be a major crisis for innovation and high technology in the country. Without a continuous increase of arms components imports, especially certain kinds of sophisticated products which are too expensive for domestic production, there would be repeated upward revisions of the rate of increasing costs for R&D : higher costs would reduce the competitiveness of French arms in international markets. Reduction of exports has a negative effect on military R&D because of the growing share of self-financing.

These arguments are difficult to evaluate from a strictly economic point of view, especially as French industry has definite handicaps - such as a limited domestic market

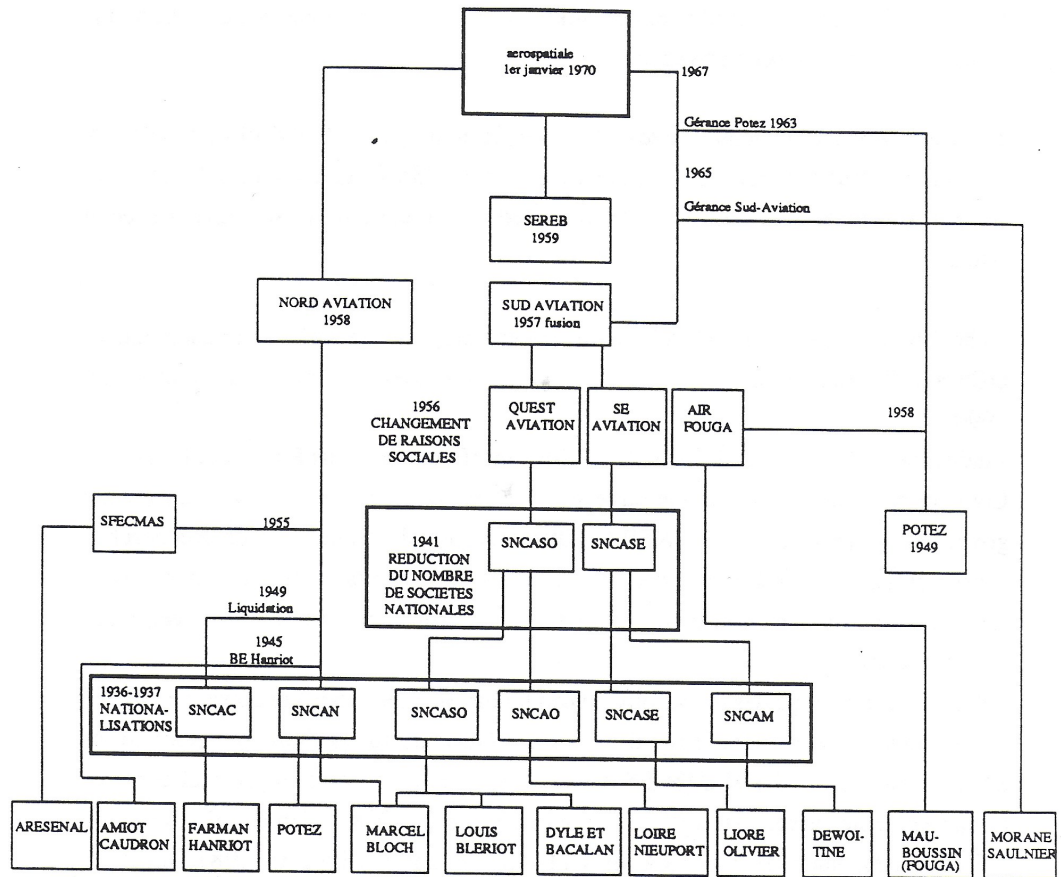
which leads it to look for exports on which it may become dependent and the dissipation of industrial effort among all types of arms. If the domestic market is not adequate in depressed conditions, the risks of selling at a loss abroad and of paying the research and development costs and part of the fixed costs for one's customers are considerable ; in this case, it is the desire for independence and security which leads to the additional costs. Some exports impoverish a country, although not the enterprises concerned. Over the long term, France's arms exports appear to fall into this category. From 1975, arms exports were financially very rewarding for French enterprises and, perhaps, for the French economy, but since 1983 this situation has changed. Given the size and volatility of the international market, the weak demand and the entry of many new competitors, the likely return from arms exports is not great, particularly in terms of opportunity costs.

The French government has recently appealed to armament firms to increase their R&D contributions and has so far not been reluctant to import some military equipment. For the *"first circle"* (premier cercle), like nuclear forces, spatial or aeronautic industries, however it will preserve its industrial plants, especially in high technology sectors. Despite this there is a desire to control costs to develop European collaboration and to preserve a very competitive industrial sector.

There has been a constant concentration process amongst French arms firms. For example, before 1936, the French aeronautic industry had 13 enterprises (Lioré et Olivier, Dewoitine, Blériot, Loire-Nieuport, De Perdussin, Bloch, Bréguet, AFN, CAMS, Potez, SECM, Farman and Hanriot). After nationalization in 1936, there were six enterprises (SNCASE, SNCASO, SNCAM, SNCAN, SNCAC) and after 1959, three other groups were created (Sud-Aviation, Nord-Aviation, SEREB). In 1970, these enterprises were concentrated in one firm: l'Aérospatiale (see Diagram 5).

The private sector of the French arms industry was significantly reduced by the nationalization programme of the Socialist government in 1981. Nine industrial groups were affected; with Thomson-Brandt, Dassault-Breguet and Matra, being the major arms producers. Aérospatiale and Dassault-Breguet share the French airframe industry, the second one being more involved in military goods. Matra and Aérospatiale control the missile market and SNECMA is the principal engine manufacturer in France. The armament sector of the electronics industry is controlled by Thomson-CSF and Dassault Electronique. The French private sector in arms is however limited because of the nationalization process and the international market crisis which was very intense

DIAGRAM 5: THE HISTORY OF AEROSPATIALE



until 1983-84. After nationalisation, Matra and CGE (now Alcatel-Alsthom) were privatized in 1986. In July 1990, GIAT became a national company with the same kind of SNPE statute as, SNECMA or Aérospatiale. This is not privatization, but provides for greater scope for commercial flexibility to face the pressures of a competitive international market. GIAT-INDUSTRIE is now able to behave more aggressively, as witness its purchase of Luchaire-Defense (ammunitions) and Matra-Manurhin-Défense; its control of FN-HRESTAL and PRB from Belgium; its agreement with Creusot-Loire-Industrie (C.L.I.) for the purchase of DMS (tanks); and its negotiation with C.L.I. and R.V.I for the production of tanks. At the same time some minor subsidiary companies have also been privatized.

There are two main judicial statutes: the arsenals (mainly the naval dockyards of DCN and aeronautical repairs) and the public companies ("Sociétés anonymes") which are subject to private law. But most state owned armament enterprises have a special status:

- The "Régies directes par l'Etat" (State stewardship) are industrial establishments of DCN and DCAé depending on the DGA. GIAT-Industries has a new statute since July 1990.
- Industrial and commercial Public Establishment (Etablissements Publics Industriels et Commerciaux ou EPIC) have the same activities as private enterprises, but they are not governed by private law. ONERA (Office National d'Etudes et de Recherches Aérospatiales), which is both concerned by military and civilian researches, has its own resources and its administrative and financial control is undertaken by government commissioners.
- Nationalized Companies are wholly owned by the State, but they are concerned by the private law. L'Aérospatiale (or the Société Nationale Industrielle Aérospatiale or SNIAS) and GIAT-INDUSTRIES are the best examples of this judicial form of armament enterprises, as well as some branches of CGE (Compagnie Générale d'Electricité), such as SINTRA or CIT-Alcatel nationalized in 1981 until the privatization of 1986.
- Some public companies associate State and private capital. For SNPE (Société Nationale des Poudres et Explosifs) and SNECMA, the State holds respectively 99.81% and 99.0% of total shares. For Matra, it had 51% of the company's shares and for Dassault-Aviation it has a majority on the decision-making general board, without having a majority on the decision-making general board, without having a majority of the capital. For SEXTANT AVIONIQUE (34%), the State is a common shareholder.

The government is able to control these firms, however, because the armament sector is a monopsonic market. In general this has been a mixed blessing for the government because the nature of defence sales has become problematic for all states from the middle of the 1980s. This is revealed when one analyses the French arms industry in detail. It is clear that there has been a constant growth of military enterprise turnover, an increase of exports of arms up to 1986 (particularly in air exports) and a crisis in the international weapons markets, thereafter, with a constant reduction of personnel due to *"labour saving"* production techniques. These developments are summarised in Tables 27 to 29.

TABLE 27: FRENCH DEFENCE INDUSTRY TURNOVER, PERSONNEL AND EXPORTS (in billion current french francs and personnel)

Years	Turnover	Exports(delivery)	Personnel
1970	14.0	2.7	
1971	14.8	3.0	
1972	16.7	4.0	
1973	20.1	5.2	
1974	22.5	6.7	
1975	25.8	8.3	
1976	31.1	11.6	
1977	35.8	14.7	
1978	42.7	17.3	
1979	50.6	20.5	
1980	58.7	23.4	
1981	69.8	28.5	
1982	75.5	28.9	
1983	86.1	33.1	
1984	98.3	41.9	
1985	104.5	43.9	290000
1986	108.0	43.1	281000
1987	107.0	34.1	271000
1988	116.2	38.2	262000
1989	120.2	37.3	261000
1990	125.3	38.6	255000

Sources: Rapports Parlementaires, See BRANGER: AVIS "Recherche et industries d'armement". (Assemblée Nationale, 9 October 1991, Doc No. 2258 tome VI).

TABLE 28: TURNOVER OF MILITARY CATEGORIES PRODUCTIONS (in percentage)

Years	Air	Army	Navy	Electronic	Nuclear	Others
1985	34	17	10.5	29	5.5	5
1986	34	17.5	10	27	6	5.5
1987	33.1	18.2	9	34.1	5.8	6.8
1988	28.0	15.0	10	31	8	8
1989	28	15	10	32	8	7
1990	32	15	9	33	5	6

Source: Rapports Parlementaires "Recherche et industrie d'armement" Assemblée National Yearly.

TABLE 29: EXPORTS BY CATEGORIES OF EQUIPMENT (WITH ELECTRONIC COMPONENTS) (in percentage)

Years	Air	Land	Sea
1985	50.3	31.0	18.7
1986	55.0	25.7	19.0
1987	53.4	37.2	9.4
1988	52.4	39.8	7.9
1989	54.7	37.3	8.1
1990	55.2	32.6	12.2

Source: Rapports Parlementaires "Recherche et industrie d'armement" Assemblée Nationale Yearly.

The present situation in which France produces most of its defence equipment needs domestically results from a policy of national independence, with the build-up of an independent nuclear force and the will to produce a large number of weapons systems. The capability and facilities developed for nuclear weapons also gave a strong impetus for autarky in conventional weapons. This policy did not imply a search for self sufficiency. Aeronautic production has a long tradition in France and land weapon systems controlled by GIAT have been protected from imports in order to tailor the arms required by French forces to their strategic needs and to protect regional economies involved in production. French weapons imports represent less than 10% of the military equipment expenditure of the Ministry of Defence. The shares of air, land or sea equipment imports vary considerably year by year, depending on the nature of the contracts and the requirements of French security.

(ii) Defence Firms in France

The twenty largest French arms enterprises are very important to the national economy and receive a very large part of the equipment expenditure of the Ministry of Defence.

Including subsidiaries, the "public" sector in France accounts for about 85% of the French arms industry. There is direct management (25% of arms industry turnover) by a state agency (DCN, CEA), 100% state-owned companies like Aérospatiale, SNECMA, SNPE, GIAT, (with 20% of total turnover), companies where the State owns, directly or indirectly, more than 50% of the shares like Thomson-CSF, Dassault Aviation, RVI (with 40% of total turnover) and private enterprises like Matra, Dassault Electronique, Sagem, Labinal, (with 15 % total turnover).

It is, however, difficult to distinguish whether some particular transactions, such as aircraft or electronics components which have a dual use, should be classified as civil and military. In the arms market the transaction price is rarely well defined. The transfer takes place as a part of a package involving the equipment itself, spares, training, access to technology, export credits, insurance for payment, offset agreements and counter-trade arrangements. Hence, the national export figures are very difficult to analyse. The net costs or revenues to the countries concerned may be different from the nominal prices.

Developing countries comprise the major source of demand for internationally traded weapons. In the 1970s and 1960s weapons transactions became more commercial, as OPEC oil revenues provided an alternative source of finance for purchase. Alongside these quantitative changes there were important qualitative changes in demand. Initially, the weapons transferred to the Third World had largely been obsolete, outdated or second-hand. During the 1970s the most modern weapons systems produced by industrialised countries were being sold. This change is a consequence of the aggressive commercial policy of French private military enterprises.

International sales of arms and technology were progressively detached from foreign policy and strategic objectives. The economic reasons invoked for exporting arms tend, as a result, to become the usual rule in the market and buyers are able to obtain the highest technology products for conventional armament. The French government wanted to maintain an national arms industry, mainly to ensure national independence of supply and access to the latest military technologies. Under these conditions, export sales at prices above short-run marginal cost made some contribution to investment costs. In political terms by supplying arms, France had the potential to influence directly or indirectly the behaviour of customers and to assist its friends. The 1980s have seen the beginning of a trend towards appropriate technology weapons, cheaper and better tailored to Third World needs, sometimes supplied by Newly Industrialised Countries. In 1987, although it was a good year for the weapons trade, the exports of the French arms industry were reduced by 18.6 per cent in comparison with 1986, with reductions of 14 per cent in the developing countries and 50 per cent in the industrialized countries' markets. From 1984 to 1986, French arms export orders were 61.8, 44.5, and 25.3 billion francs respectively, because of the impoverishment of French customers, the fall of the dollar exchange rate and international competition. during this time, FRG and U.K. arms exports were growing. From 1986 to 1991 the exports of the French arms industry were reduced considerably (see Tables 29 and 30).

It is interesting to note that the arms exports of French industry are not really in crisis yet, because deliveries lag behind orders, but present orders are very low. If we bear in mind that orders are usually higher than deliveries, the arms industry will be in serious trouble in the foreseeable future.

TABLE 30: FRENCH MILITARY EXPORTS AND IMPORTS (in billion current french francs)

Years	Military Equipment Exports	Military Equipment Imports
1970	2.4	0.4
1971	2.8	0.5
1972	4.0	0.7
1973	5.2	0.9
1974	6.7	1.5
1975	8.3	1.7
1976	11.6	2.1
1977	14.7	1.5
1978	17.3	1.6
1979	20.5	2.0
1980	23.4	2.3
1981	28.5	2.5
1982	28.9	2.8
1983	33.1	3.3
1984	41.9	3.9
1985	43.9	5.2
1986	43.1	4.1
1987	34.1	4.8
1988	38.2	9.3
1989	37.3	13.5
1990	38.4	6.7

Source: Rapports Parlementaires.

TABLE 31: FRENCH MILITARY EXPORTS AND IMPORTS (in billion constant 1990 french francs)

Years	Military equipment Exports	Military equipment Imports
1985	51.14	6.06
1986	48.88	4.65
1987	37.51	5.28
1988	40.91	9.96
1989	38.57	13.96
1990	38.40	6.60

Source: Rapports Parlementaires for exports and customs data (Bulletin mensuel de statistique de l'INSEE).

TABLE 32: FRENCH MILITARY EXPORTS BY REGIONS (%)

Country	1985	1986	1987	1988	1989
Maghred & Middle East	60.2	53.6	54.0	47.9	56.0
Europe & North America	14.1	16.7	24.9	32.2	31.6
Far East	16.0	13.0	11.7	12.3	5.4
Latin America	4.8	10.7	5.9	3.9	4.6
Black Africa	3.6	5.1	2.6	3.1	1.6
Others	1.4	0.9	0.9	0.5	0.8

A supplier with an effective monopoly of a desired weapon system is able to extract a high political price. This is rarely the case for France which produces arms in competition with many alternative sources of supply. Thus its exporting position is not so strong as it was because of the new competition, characterised by the absence of political conditions, between arms enterprises.

The Parliamentary Report on French Military Industries explained the international market crisis of the weapons trade as due to the decrease of resources of French buyers, the emergence of new arms producers and the weakness of the French system of arms sales, with some financial rigidity and the ageing of marketing companies. Some British commercial successes are used as an example with their barter agreements with Saudi Arabia (Tornado) and Malaysia. The Parliament Report recommends improvements in the financial and insurance statements of arms exports and the systematic use of certain diplomatic decisions for commercial agreements. For instance, Paris will help India to design its aircraft carrier at Cochin in the Kerala State with the assistance of French technical personnel.

Desire for weapons does not constitute an effective demand unless financing is also available and in a world crisis it is difficult to maintain arms transfers in the long run without any financial guarantee of effective payment. But, for the French arms industry it is vital to export and the Parliamentary Report pleads for a new products policy better defined for international uses, quality research, a wider geographical market, commercial attempts at direct foreign implantation, improvement of risk insurance for the military sector and improvement of French and European industrial collaborations. This is a political, not an economic, decision.

Political control on arms exports is exercised by the Prime Minister and the Secrétariat Général de la Défense Nationale (SGDN), which organizes la Commission Interministérielle pour l'Etude des exportations des matériels de guerre (CIEEMG),

chaired by the Secrétaire Général de la Défense Nationale, with the representatives of the Ministers of Defense, Foreign Affairs and Economy and There are the "*Clause de la destination finale*" (end use control, but without any analysis of re-export possibilities) and the control of export operations with some countries (South Africa, Iraq, Libya, Syria) and more generally the Coordinating Committee (COCOM), which has had little to do since the crisis facing the Soviet Bloc arose.

Military equipment must not leave the national territory without an export authorisation for war material (AEMG, autorisation d'exportation de matériel militaire), controlled by positive advice from Ministry of Defence, Foreign Ministry and Secrétariat Général de la Défense Nationale (SGDN). There are many export restrictions on products (nuclear, chemical, or new generation electronic war systems) and on destinations (racist, fascist and dictatorial States).

During the 1970s, France made skilful use of its special status and relative independence from the two superpowers, and of the weakness of political conditions on French arms sales, to obtain a share of the international weapons market. During the 1980s this advantage has been substantially reduced by the "*demonstration effect*" involving both new arms producers, like West Germany and Brazil, and even the two superpowers. Thus, the competitive position of the French arms industry is in decline.

As a consequence in recent years there has been a shift towards collaboration. French industry has had considerable experience in collaboration and joint ventures with firms from other countries. By and large these, as Tables 33 to 35 reveal, have been with European partners. There are two types of MOUs (Memorandum of Understanding). Some bilateral MOUs are on general questions, such as the MOU signed with the United States on security problems. The more usual are those which organise a partial or a global cooperation. There is no complete statistical analysis of MOUs by the services of the Ministry of Defence because there are so many. Often a single programme gives several MOUs, such as the Euroflag, Roland, Hermes, MLRS, Otomat and Transall projects.

Sub-Contracting:

The figures for the share of sub-contracting in the French arms industry are not readily available, but it is possible to give some characteristics about this kind of relationship. Defence contracts are awarded after competitive bidding, but most often competition is limited to the companies which are considered most valuable, after a public call for

candidates. With the existence of monopolies, competitive developments can only be afforded for components or minor subsystems (DCN for military shipyards, Aérospatiale for strategic missiles and for helicopters, Dassault Aviation for combat aircraft, SNPE for propellant and explosives). Sub-contracting is closely related to the economic sector. For instance, electronics, where the real spin-off is from civil to military uses, is the best example of sub-contracting.

Overall, however, it is difficult to calculate the importance of sub-contracting as Table 38 indicates. Is subcontracting started with prime contractors or with the first-level contractors? The question is not clear. If it is the first answer, sub-contracting represents certainly more than two-thirds of the arms production. If it is the second answer, then sub-contracting represents only 40 % of total output. But these estimates are not very precise, because of the complexity of production organisation, and sometimes the same enterprise can be both the prime contractor and sub-contractor.

TABLE 33: CO-OPERATIONS ON MILITARY EQUIPMENT STUDIES

Programme	Weapons	Joint venture	Companies
EUROFLAG	airlift		Aérospatiale DASA BAe CASA Alenia
NH 90	Helicopters		Aérospatiale DASA Fokker Agusta
NH 90	Gun turret		GIAT General Electric
ROLAND Mach 5	air defence	Euromissile	Aérospatiale Matra, DASA
ROLAND Mach 5	future air defence systems	Eurodynamic s	Thomson-CSF (50%), BAe (50%)
ANS	missiles anti-ship		Aérospatiale, MBB
MILAS	Torpedo launcher		Matra, Otomelara
MLRS phase 3	terminal guides submunitions		Martin-Marietta Thomson-CSF Thorn-EMI, DIEHL
MACPED	area-effect anti-tank mine		GIAT, Honeywell, DNAG, Hunting
APGM	autonomous precision- guides munition	ASP	International consortium with Matra
ACED	"smart" anti-tank projectile		International consortium with Thomson-CSF

TABLE 34: CO-OPERATIONS ON MILITARY EQUIPMENT DEVELOPMENT

Programme	weapons	Joint venture	Countries
BREDA	corvette		Alsthom At. Bremer Vulkan
TIGRE	Helicopter anti-tank	Eurocopter	Aérospatiale (60%) & DASA (40%)
MTR 385/390	Tigre engine		Turbomeca MTU Rolls Royce
AC3G	missile antitank	EMDG (GIE)	Aérospatiale DASA BAe
SAMP-T	missile air defence	EUROSAM (GIE)	Aérospatiale Thomson-CSF Alenia
CROTALE NG	missile air defence		Thomson-CSF LTV Fokker
SAAM/LAMS	Naval anti-sea skimmer	EUROSAM (GIE)	Aérospatiale Thomson CSF Alenia
MICASRAAM	missile air to air		Matra GEC Marconi
COBRA	counter-battery radar	GE(US) + EURO- ART	GE (licence) Thomson-CSF Thom EMI Siemens
CL 289	surveillance with drones		Canadair Dornier, SAT
BREVEL	surveillance with drones	EURODRONE	Matra, BremerVulka n
HELIOS	satellite		Matra, Alcatel Alenia, Casa INISEL
MIDS	Multifunctional information and distribution system	MIDSCO	US-European consortium with Thomson-CSF
MU 90	Light Torpedo	GIE	DCN Witehaed-Italia
RTM 322	NH90 engine		Turbomeca Rolls royce MTU Rinaldo Piaggio

TABLE 35: CO-OPERATIONS ON MILITARY EQUIPMENT

Programme	Weapons	Joint venture	Companies
RATAC	artillery radar		LMT SEL
ERIDAN	minehunter		DCN Mercantile-Beliard Van der Giessen
TRANSALL	airlift		Aérospatiale MBB
JAGUAR	air support	SEPECAT	Dassault (50%) BAe (50%)
ALPHAJET	trainer + air support		Dassault (50%) Dornier (50%)
ATLANTIQUE 2	maritime patrol	SECBAT	Dassault SABCA Aeritalia DASA
GAZELLE	antitank, naval	HELI-EUROPE	Aérospatiale (50%) & Westland (50%)
LYNX	antitank, naval	HELI-EUROPE	Aérospatiale (50%) & Westland (50%)
PUMA	multipurpose	HELI-EUROPE	Aérospatiale (72.5%) Westland (27.5%)
TYNE	engine (Transall and Atlantic)		SNECMA Rolls Royce MTU FN Moteurs (Belgium)
LARZAC	Alphajet engine		SNECMA TURBOMECA MTU KHD
CFM 56	turbofan	CFM international	General Electric (50%) SNECMA (50%)
MILAN + HOT	antitank	EUROMISSILE	Aérospatiale MBB
MIRA	Thermal imager for MILAN		TRT Marconi Siemens
MLRS Phase 1	Multiple launcher ricket system	MLRS - EPG	LTV (licence) Diehl Aérospatiale SNIA BPD Hunting
ROLAND (1,2,3)	air defense missile	EUROMISSILE	Aérospatiale MBB
HAWK HIP	air defense missile	EUROGRIP (GIE)	Raytheon (licence) Thomson -CSF MBB Alenia
OTOMAT	antiship missile		Matra Otomelara
MARTEL	air-to-ground missile (anti-radar)		Matra BAe
ARIANE	space	ARIANESPACE	Many European companies (France = 54%)
HISPASAT	satellite		Matra BAe
NADGE	NATO air-defense ground environment		Hughes Thomson-CSF GEC-Marconi
RITA	Communication system		Thomson-CSF MBLE
NIS	NATO identification system		US-European consortium Thomson-CSF
RITA/MSE	mobile subscriber equipment		Thomson-CSF MBLE GTE (US)

TABLE 36: ORGANISATION OF THE RAFALE PROGRAMME

1- Prime contractor (35% value added) : Dassault Aviation
2. First level contractors (contracts with DGA)
- for airframe Dassault Aviation
- for the engine M 88, SNECMA
- for the radar SPECTRA, GIE RBE formed by Thomson-CSF (66.7%) and Dassault Electronique (33.3%)
- for the air-to-air missile MICA (Matra)
3- Second-level contractors (with Dassault Aviation)
- Aérospatiale : missiles other than air-to-air
- Air equipment : fuel circuit
- Auxilec : electric circuit
- Bronzavia : hydraulic ancillaries
- GIAT Industries : "black box"
- ECE : electric supply
- ELECMA : computer for engine
- EROS : elements of the oxygen circuit
- Hispano-Suiza : connectors for the engine and ancillaries
- Intertechnique : equipment for the fuel circuit
- LMT Radio Professionnelle : IFF
- Messier Bugatti : landing gear
- Microturbo (Labinal) : auxiliary power unit
- SAGEM : gyrolaser inertial system
- SECAN : elements of conditioning
- SEMMB : ejection seat
- Sextant Avionique : displays, symbols generation, radio sensors, trajectory calculator, vocal control
- Sully Produits Spéciaux : cockpit
- Tecnofan : conditioner
- TRT (now Thomson-CSF) : radio-altimeter
- Zenith Aviation : fuel circuit
4- Third-level contractors
- hundred of small enterprises.

Major sub-contractors:

Companies can be classified as prime contractors or sub-contractors. DCN, Aérospatiale and Dassault Aviation are almost always prime contractors and SNECMA, Dassault Electronique, SNPE are normally sub-contractors. Thomson-CSF, GIAT or Matra are sometimes in the position of sub-contractors, and sometimes in the position of prime contractors. Thomson is the prime contractor in the Crotale programme and a sub-contractor in the Rafale programme. SNECMA and the aerospace sector of Labinal for turbine engines, SNPE for rocket propellant, SEP for rocket motors, Sextant for avionics, are the main sub-contractors of aerospace and propulsion sectors. On ammunition and small arms, sub-contracting is not very important, clearly less than for

military motor vehicles. For electronics, Thomson-CSF, Dassault Electronic and SAGEM are often prime contractors, with a high number of sub-contractors; but they are sometimes themselves sub-contractors. 50 % of the cost of the Leclerc battletank is constituted by electronics.

Defence Sales:

The French arms industry was historically very competitive, but at the end of 1980s it is in economic crisis.

Arms sales abroad are only a very imperfect indicator of the competitiveness of the arms industry. It is therefore difficult to conclude that the arms industry is a prerequisite for France's economic development, or even that it is essential to her immediate security. Indeed, if the prices prevailing in the national economy are significantly higher than those of international competitors, the army will receive fewer arms for the same amount spent. This is the choice that has been made, by Sweden, for example, for her aircraft construction activities. Under these conditions, the country's defence is less well provided for, in the short run, by national production than by imports. However, all aspects of security and industrial development must be taken into consideration, such as embargos, national independence, the development of the national industrial fabric, etc. It is still the case however that France is unable on her own to finance completely electronic warfare weapons and space defence systems on her own. The idea of a Weapons Common Market is growing. The best example is the French-English Commission which is examining the proposals of industrialists concerning the issues of costs, delays, efficiency and national preference. This approach is not as yet to be applied to nuclear weapons. The results of this Commission appear to however to be symbolic for the moment.

For developed countries, military contracts and armament industries have created definite advantages which are politically and economically difficult to challenge. Although the international arms trade is in crisis, the strategic advantages are not negligible and disarmament could bring, in the short run, an increase in unemployment, some painful restructuring and reductions in wages. The conversion of military activities to civilian activities is not always technologically and economically feasible. Conversion is bound to be costly, because if it is possible to transform a tank factory into a factory for cross-country vehicles, the crucial questions are production costs and the size of available markets. Simply knowing how to transform a military aircraft industry into a civilian aircraft factory does not imply a similar ability to expand an

already glutted market. Causation is unlikely to be unidirectional. Inefficiency can lead industries to seek protection within military markets and excessive commitments to these markets may cause a deterioration of the domestic industrial base of the whole French economy.

TABLE 37: TURNOVER OF THE FRENCH ARMAMENT INDUSTRY
(Billion francs)

Years	turnover MOD	turnover INSEE	Exports MOD	Exports Customs
1970	14.3	15.7	2.7	
1971	15.0	19.5	3.0	
1972	16.7	19.9	4.0	
1973	20.1	21.3	5.4	
1974	22.5	26.0	6.7	
1975	25.8	33.0	8.3	3.8
1976	31.1	38.2	11.6	6.5
1977	35.8	43.8	14.7	7.9
1978	42.7	45.1	17.3	12.5
1979	50.6	47.8	20.5	12.1
1980	58.7	58.2	23.4	20.2
1981	69.8	76.1	28.5	26.3
1982	75.5	85.1	28.9	26.1
1983	86.1	96.5	33.1	28.0
1984	98.3	110.6	41.9	37.1
1985	104.5	106.4	43.9	36.0
1986	108.0	114.3	43.1	38.3
1987	107.0	113.5	34.1	31.2
1988	116.2	123.0	38.2	33.7
1989	119.9	128.0	37.3	40.7
1990(e)	124.5	130.0	38.4	34.0

Sources: DGA publications, Parliamentary Reports, INSEE, "Les comptes de l'industrie" (Yearly), and Customs Office "Bulletin Mensuel de Statistiques (INSEE).

TABLE 38: MAIN ENTERPRISES BY MAIN PRODUCTION

Air	Sea	Land	Electronics	Others
Aérospatiale	DCN (DGA)	GIAT-Industries	Thomson-CSF	SNPE
Dassault aviation	GEC-ALSTHOM	Renault-Véhicules Industriels	Dassault Electronique	CNIM
SNECMA	CMN	Thomson-Brandt-Armement	SAGEM	Messier Bugatti
MATRA	SFCN	Creusot-Loire-Industrie	SAT	Hispano-Suiza
SEP		Matra-Manurhin-Défense	Sextant Electronique	Auxilec
TURBOMECA		Luchaire-Défense	Alcatel Transmission	SAFT
		Panhard-Levassor	CSEE	Intertechnique
			-SFIM -Alcatel-Espace -Unilaser -Sogitec	-Labinal -Sochata-SNECMA -Sopelem -Sogerma-Socea -Souriau

TABLE 39: SIZE DISTRIBUTION OF FIRMS FOR EACH SECTOR OF THE MARKET IN 1989

Sectors	Companies
Aerospace	<ul style="list-style-type: none"> - Aérospatiale 26,5 % - Thomson-CSF 32,9 % - Dassault Aviation 25,7 % - Matra D.E. 10,4 % - Sextant 4,3 %
Propulsion	<ul style="list-style-type: none"> - SNECMA 52,8 % - SNPE 17,8 % - Labinal 17,3 % - SEP 11,3 %
Electronics	<ul style="list-style-type: none"> - Thomson-CSF 21,6 % - Dassault Electronique 7,5 % - Sextant 5,3 % - SAGEM 4,2 % - TRT 3,2 % - SAT 2,1 %
Shipbuilding	<ul style="list-style-type: none"> - DCN 62,1 % - CMN 2,9 %
Ammunition and small arms	<ul style="list-style-type: none"> - GIAT 48,5 % - SNPE 9,8 % - TBA 15,5 % - Matra Manurhin 9,3 % - Luchaire 8,5 %
Motor vehicles	<ul style="list-style-type: none"> - GIAT 43,6 % - RVI 36,4 % - Panhard 9,7 % - Creusot-Loire 6,2 % - SAMM 1,7 %

Source: Rapports Parlementaires

TABLE 40: OWNERSHIP OF FRENCH ARMS ENTERPRISES

Main sectors	Public	Private
Aerospace	Aérospatiale SNECMA Dassault Aviation (but the private sector has the main part of the shares, but the government has the main part of the votes)	Matra Turbomeca
Land	GIAT Industries SNPE Creusot-Loire-Armement Thomson-Brandt-Défense Matra-Manurhin-Défense Luchaire-Défense R.V.I.	Panhard et Levassor
Shipbuilding	DCN	Alsthom CMN SFCN
Electronics	Thomson-CSF Sextant Avionique	Dassault Electronique Groupe SAGEM Groupe CGE

Military R&D is very significant in the French economy and its actors, contracts and procedures are of a particular kind. Three characteristics of technology developed by military R&D are of particular importance :

- 1) A propensity to seek out the most sophisticated technology which is not suitable for civilian production,
- 2) An inherent capital-intensiveness, without regard to production costs,
- 3) An excessive secretiveness.

The concept of R&D covers a vast range of activities, such as basic research or the improvement of production procedures. Military R&D is not exclusively devoted to making advances in the area of destruction but also protection, both swords and shields. But it is very difficult to obtain precise figures on R&D. In France, official publications give different figures, under the same title. The comparison of data between sectors is also not very easy because, for a nuclear submarine, it is very difficult to define exactly what is development and what is production. The relative weight of military R&D in the total national R&D programme gives rise to continual debate.

There are four main sources of finance for military R&D : public funds, exports, co-operation and private engagement. For nuclear armaments, public finance is preponderant, and often exclusive. Before the Second World War, modern weapons were the result of adapting civil technology. Since 1961, the Délégation Ministérielle pour l'Armement (DMA) and since 1977 the Délégation Générale à l'Armement (DGA) have had the main responsibility for military R&D. The most important characteristic of defense research compared with civil research is its very high level of integration.

The French DGA is not only a procurement agency but also employs a number of experts in military and dual technologies who reduce the negative aspects of the cost-plus system by serious selection and control of the laboratories under contract. The ratio of R&D to the total defence equipment military budget accounts for 30% of the costs of armaments. The expenditures are shared as follows: electronics 25%, land and sea-vehicles and ammunition 22%, nuclear 20%, aircraft 18% and missiles 15%. The R&D programme is carefully planned, on the basis of proposals of government agencies and industry, cross-examined against long-term military needs. It is organized by DGA by types of products or technologies and not by users in order to avoid duplications. The Ministry of Defence is thereby the tutor of the whole aerospace

industry. This is because the executives in charge of the design and development of the weapons, and those in charge of their use, are all under the authority of the omnipotent Minister of Defence. Concertation among all partners is possible. Research is mainly conducted by departments, especially the "*Direction des Recherches Etudes et Techniques*"(DRET), administered by the Délégation Générale pour l'Armement and the Direction Centrale du Service de Santé des Armées (DCSSA). DRET is entrusted with the co-ordination of upstream programmes and is in charge of conducting research work, in particular basic research.

Research is mainly conducted within the various directorates which depend on the Délégation Générale pour l'Armement and the Direction Centrale du Service de Santé des Armées, but among these directorates, one of them plays a particular role : the Direction des Recherches Etudes et Techniques (DRET). Its mission is twofold : both functional and operational. As a functional directorate, DRET is entrusted with the co-ordination of upstream studies (programme preparation, stimulation of concerted discussions with the staffs, technical coordination in the fields of common interest, scientific and technical documentation). As an operational directorate, DRET is in charge of conducting research work, in particular basic research, or having it conducted, in its own establishments or those under State control : ONERA (Office National d'Etudes et de Recherches Aérospatiales) and ISL (Institut franco-allemand de recherche de Saint-Louis).

The general policy in terms of studies is examined every year by a Conseil des Recherches et Etudes de Défense (CRED) which gathers, under the effective chairmanship of the Minister, the Chiefs of Staff, the General Delegate for Armament and all the high-level executives of the Ministry involved in defence research. In particular, CRED deals with structures, programmes, budgets and scientific trends. A Conseil Scientifique de la Défense composed of scientific personalities who do not belong to the Ministry is in charge of advising the Minister on the research work to be undertaken and on the participation of the national scientific community in defence efforts.(Bindel,1983)

There is a link-committee between the executives of the Ministry of Research and the research executives of the Ministry of Defence, because the defence and civil research organizations are independent of each other. The ONERA, which is under the control of the Ministry of Defence, works towards dual applications and many of the results are applicable to every type of aircraft. It is the same for the Centre National d'Etudes Spatiales (CNES) and Bassin d'Essais des Carènes (experimental towing tank) which

are used respectively for the development of satellites and for naval hydrodynamics. Co-operation (exchange of information, placing of research contracts, grants for young researchers, for example) with public agencies, such as the Centre National de la Recherche Scientifique (CNRS), are often a way of improving the usefulness of fundamental research.

Small and medium-sized enterprises are not often involved in military R&D contracts, although they are particularly capable of rapid technological innovations. But relations with the defence sector is usually established through prime contractors of whom they are sub-contractors. In 1984, DRET decided to create an Industry Mission in order to inform the small and medium-sized enterprises of defence research results, to ensure that they are applied in the civil and military sectors and to detect new technologies originating from these enterprises and capable of integration into future weapons systems. The results are rather good, with 1200 firms in touch four years later and some effective exchange of technologies (15 % of cases).

A group of personalities have been asked by the Ministry of Defence to consider the measures needed to develop DGA's relations with small and medium-sized enterprises (SME). The conclusions mention the *"creation, around the DRET Industrial Mission, of a real network of innovation inside the DGA, relying on correspondents in each directorate or major establishment ; development of information for the SME and, more generally, of the Defence partners ; setting up of special technological programmes for SME ; and, reinforcement of the technological potential of SME (financial means, aid to personnel training..etc)"*.

The following tables present information on the main suppliers to the French state for defence equipment.

TABLE 41: DEFENCE TURNOVER OF THE MAIN SUPPLIERS OF THE MINISTRY OF DEFENCE (billion current francs) C.A. "armement".

Enterprises	1985	1986	1987	1988	1989	1990
Aérospatiale (a)	16.2	15.82	16.1	13.7	13.9	15.4
AMD-BA(b)	14.7	13.38	10.3	12.3	13.5	12.3
E.S.D.(c)	2.1	2.40	2.8	3.3	3.2	2.9
Luchaire(d)	1.4	0.50	0.5	0.5	0.6	
Matra-Manurhin-Defense(e)	0.95	0.97	1.0	0.9	0.7	
Matra (a)	4.15	3.04	4.9	5.1	4.5	5.0
Panhard et Levassor	0.67	0.66			0.66	
R.V.I.	0.7	0.60	1.4	1.6		
SAGEM	1.4	1.59	1.4	1.9	1.8	2.1
SNECMA(a)	4.2	4.62	3.6	4.6	5.7	5.1
S.E.P.	0.96	0.98	0.9	1.0	1.0	1.0
SNPE	1.3	1.84	1.7	1.8	1.8	1.8
Thomson-CSF	10.4	16.71	21.0	19.7	21.8	20.3
Thomson-Brandt-Armements	1.7	0.88	0.9	0.9	1.2	
Turbomeca	1.4	1.24	1.4	1.5	1.6	1.6
Sextant Avionique						2.2
GIAT-Industries						7.5

Source : Rapports parlementaires "Recherche et Industrie d'armement".

- (a) without subsidiary companies
- (b) now Dassault-Aviation
- (c) now Dassault Electronique
- (d) now Luchaire Défense (GIAT-Industrie)
- (e) now GIAT-Industrie property.

TABLE 42: THE MAIN FRENCH ARMS FIRMS IN 1989 (billion francs)

Enterprises	Total turnover	Armement turnover
Aérospatiale (without subsidiaries)	31.7	13.9
Dassault Aviation	17.4	13.5
Dassault Electronique	4.1	3.2
Luchaire (GIAT Industries)	0.6	0.6
Matra-Manurhin-Défense (GIAT)	0.7	0.7
Matra	7.2	4.5
Panhard & Levassor	0.7	0.7
R.V.I.	19.2	2.0
SAGEM	4.9	1.6
SNECMA (without subsidiaries)	13.5	5.7
SEP	4.3	1.0
SNPE	3.1	1.8
Thomson-CSF	25.8	21.8
Thomson-Brandt-Armaments	1.2	1.2
Turbomeca	2.5	1.6

Source: Rapports Parlementaires "Recherche et industrie d'armement."

French defence statistics use five main industrial sectors within the armament industry.: aerospace (30%), electronics (30%), shipyards and arsenals (14%), mechanics and metallurgy (9%), nuclear (6%) and others (9%). It is also possible to provide data on the performance of the aerospace industry. It is more difficult for electronics because of the dual-use of its production.

TABLE 43: DATA ON AEROSPACE INDUSTRY (CIVIL AND MILITARY)

(In personnel units and million francs)					
Date	1985	1986	1987	1988	1989
Personnel	127072	126056	122377	119484	120334
Imports	9897	11421	14617	15169	18591
Turnover	85334	89541	90056	100381	110849
Military turnover	57714	56948	50161	55134	58750
Exports	43990	45480	45239	49386	55012
Net income					
R&D (without State)					
Total R&D					

Source: GIFAS (1989-1990) "Rapport d'activité", Paris.

THE MAIN FRENCH DEFENCE SUPPLY FIRMS

Thomson-CSF

Thomson-CSF (with 40 % of stock private with holders) is the second largest world and premier European defence electronics manufacturer, with 28% of the European market. It produces rocket motors and missile components, naval command, radar, control, weapon, aircraft cockpit-related systems, simulation and training equipment and electronic components. It is a constant loss maker and it received two billion francs capital increase in 1991. It has been restructured and it is difficult to compare data from one year to the next. Its acquisitions are Forge de Zeebrugge (Belgium) and Wilcox (USA) in 1988, HSA, Philips defence activities (Netherlands), MBLE (Belgium) and TRT (France) in 1989 and Link Miles (USA). Its sales are Bronzavia A.E. to Lucas (United Kingdom) in 1988. Its main subsidiaries are SGS Thomson Electronics (50/50 with I.R.I.), ATEV holding company (50/50 with Aérospatiale) which owns 55% of

Sextant Avionique, Altus Finance (50/50) with Crédit Lyonnais. It has undertaken mergers between Ferranti (50%) (with Ferranti Thomson Sonar Systems), Eurodynamics with (Aérospatiale) for the air defence systems and missile electronics fields. Its profits fell by 18% in 1990 and it expects a 20% overall reduction in sales up to 1993, mainly in the military sector. Thomson-CSF is an important subcontractor of Dassault and Aérospatiale.

TABLE 44: THOMSON-CSF (WITHOUT SUBSIDIARY COMPANIES)

(in personnel units and million francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	29455	29558	29140	25130	29500	22890
with engineers	6257	6648	7139	7219	9000	
Turnover	18553	21748	27248	24863	25800	23649
Military turnover	10400	16710	21000	19700	21800	20300
Exports	8819			14950	16200	14300
Net income	999	1968	949	1526		1033
R&D (without State)	1786	2025	2495	2301		2030

Source: Annual Reports (data not consolidated).

Aérospatiale

The French State is the only shareholder of Aérospatiale (receiving a 850 million francs increase in capital in 1991). It produces aircraft (fixed or rotary wing) (38%), missiles (22%), satellites and helicopters, (22%). Its military sales have been reduced and now civil production is up to 50%. It had modest profits of 200 million francs in 1989, but profits fell sharply (80%) on a static turnover in 1990. It has been restructured, with the merger of Crouzet/SFENA/EAS from Aérospatiale and Thomson AVG to create Sextant Avionique, the creation of UNILASER which gathers the French laser activities, the creation of EUROCOPTER (60 % for Aérospatiale and 40 % for MBB) on helicopters activities, acquisition in 1990 of 15% of Loral Space Systems (USA) with Alcatel and Selenia and in 1991 it founded a new missile company with SNPE and it is close to helicopter cooperation with Kawasaki (25% of the Japanese market). Aérospatiale has many partners and co-operative ventures (GIE Airbus, GIE ATR, GIE Euromissile, GIE EMDG, GIE Eurocopter, GIE EUROSAM, ANS (antiship missile), APACHE (stand-off remote fired ammunition carrier), MLRS (multiple Launcher Rocket System), Hermespace, Euroflag, Ariane programme, Meteosat, etc. On space activities, the Aérospatiale-Alcatel group is second in the world after Hughes.

TABLE 45: AÉROSPATIALE

(in personnel units and million francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	36137	35544	34408	33192	33222	33800
With engineers	6607	6786	6927	7095	7501	8042
Turnover	24595	25411	24890	27984	31700	32800
Military turnover	16200	15820	16100	13712	13900	15400
Exports	14684	15602	15506	16478	18875	18400
Net income	454	227	50	93	204	38
R&D (without State)	3214	3400	2594	1700	2500	2500
Total R&D	6830	6900	7400	8100	11000	12600

Source: Annual Reports (data not consolidated).

Dassault Aviation

Dassault Aviation is a private company, heavily involved in the military sector, but if the private sector has the main part of the shares, the government has the main part of the votes.

TABLE 46: DASSAULT AVIATION SHAREHOLDERS

Owners	Shares properties	Voting rights
Financière & Industrielle Serge		
Dassault Company	49.75 %	41.52 %
French state	25.95 %	21.66 %
SOGIPA (French State)	19.80 %	33.07 %

Its main products are aircraft (60% of sales are generated by Mirage fighters for French defence), aviation service, simulation and training equipment and executive aircraft. Dassault Aviation is in crisis, with depressed sales and a 65% drop in profit at the beginning of 1990, when military exports collapsed, and deliveries of Mirage F-1 to Iraq were abandoned. It has received governmental support for the Rafale programme despite rising costs. It plans to increase non-military products to more than half of total turnover by 1994. Restructuring is taking place with four plant closures and 4000 job losses. Dassault Aviation has two main subsidiaries (SOGITEC with 220 million francs turnover and Dassault Systèmes) with a majority. Its co-operation partners are SNECMA, Thomson CSF, Aeritalia and Aérospatiale.

TABLE 47: DASSAULT AVIATION

Date	(in personnel units and million francs)					
	1985	1986	1987	1988	1989	1990
Personnel	16123	15783	14676	13818	13385	12390
With engineers	2946	3017	3016	3076	3179	3215
Turnover	16439	15602	15545	17661	17400	17100
Military turnover	14700	13269	10316	12365	13500	12320
Exports	9276	8626	5393	7787	7738	7525
Net income	459	293	192	146	254	218
R&D (without State)						
Total R&D						

Sources: Annual Reports (data not consolidated).

Direction des Constructions Navales (DCN)

This is not a company in a legal sense. It is the major French military shipbuilder and integrator of naval weapons and electronics in naval system.

DCN is the most important French shipbuilding firm. The civilian shipyards have suffered a severe crisis, going from 28883 jobs in 1983 to only 10875 in 1989. The production of nuclear-fuelled ballistic missiles submarines is very expensive, because there is no mass production. It is construction unit by unit, with some costs reductions, through learning from experience and common investments. Eight submarines (SNA) were ordered, of which five were delivered (Rubis, Saphir, Casabianca, Emeraude and Améthyste). The aircraft carrier (Charles de Gaulle) will be produced before 2000.

TABLE 48: DCN AND ITS COMPONENTS

Branches	Production
DCAN Brest	Maintenance of Strategic Oceanic Forces Maintenance of Surface Combatants Construction of major vessels
DCAN Cherbourg	Construction of nuclear strategic submarines (Strategic Oceanic Forces)
DCAN Lorient	Construction of medium vessels Maintenance of submarines and surface combatants
DCAN Toulon	Maintenance of aeronefs and fleet
ECAN Ruelle	Weapons system Naval cybernetics Ship handling
ECAN Indret	Classical and nuclear propelling apparatus
ECAN Saint-Tropez	Research and manufacture of torpedoes.
ECAN Papeete	Pacific Fleet Support

Results are rather favourable in four or five establishments. The others, however, are in crisis DCN has structural handicaps :

- Administrative constraints (more than a third of the employees work on tasks which would not occur in a private firm.).
- The Finance Law indicates every year the number of jobs, to be provided, with their qualifications. As a result, the enterprises are not very flexible in international markets.
- Personnel are usually civil servants and their status is related to that of the civil service.
- The Allarde Law forbids the Arsenal to compete with private enterprises.
- An absence of scope to improve the management of the firms. It has a main client, with prices calculated on a cost basis, and thus DCN has no incentive to obtain financial equilibrium of its public establishments.
- The number of engineers and highly skilled personnel is less than 50 % of what it should be.

There is no data on financial performance, but there is a yearly analytical accounting report. There are 8,200 workers in shipbuilding and 6,200 for repairs and maintenance. It is only allowed to export through governmental negotiations. It is wrong to assign the whole turnover of the DCN to a fictitious company. The shipbuilding activity only represents 62% of its industrial turnover. Now, its main production is nuclear-powered aircraft carriers, nuclear-powered submarines, anti-submarine and air-defence frigates and torpedoes. DCN is a systems integrator which mainly builds the hulls and incorporates all other weapons and engines. For 1989, there are more than 30,000 employees, 12.7 billion francs of turnover, 470 million francs of exports and more than one billion francs for R&D.

Groupement Industriel des Armements Terrestres (GIAT-Industries)

Since 1990, GIAT has been a public company, which produces mainly army weapons. GIAT is the largest supplier to the Army. It conceives, studies and produces about 200 arms or arms systems, and the branches at Bourges and Versailles/Satory are specialized in R&D. G.I.A.T., employs 15,000 staff and has ten industrial plants (Bourges, Le Mans, Roanne, Rennes, Saint-Etienne, Satory, Salbris, Tarbes, Toulouse and Tulle). Before 1990, it had no autonomy, no financial and legal personality. Its manpower was decided by the "*Loi de Finance*" and wages were not included in the normal management of the enterprises, but were decided by the rules governing the civil service.

TABLE 49: MAIN BRANCHES OF GIAT AND THEIR ACTIVITIES

Establishments	Productions
AMX-APX Sartory	R&D, tanks, armoured vehicles
EFAB Bourges	R&D pyrotechnics and major calibre weapons
ATS Tarbes	Pyrotechnics, shells, armoured equipments
ARE Roanne	Armoured frames, assembling and re-building.
MAS Saint-Etienne	Light weapons, detection and protection equipments, NBC-rockets and ammunitions
MAT Tulle	Automatic weapons medium calibre
ATE Toulouse	Small and medium calibre, electronic equipments, mines.
ALM Le Mans	Small calibre ammunitions
ASS Salbris	Medium and major calibre loading
ARS Rennes	Small and medium calibre ammunitions, artillery elements, shelter assembling and armoured equipments.

The market position of GIAT has been deteriorating. Between 1983 and 1987, orders declined 40 %. GIAT had a deficit of 400 million francs in 1987 and overall productivity declined. It was very difficult to create alliances and financial or industrial participations. GIAT was unable to take financial participations, to have cooperation agreements with French or foreign companies or to negotiate for industrial property. It was forced to buy from national traders, although their performance was not comparable with foreign competitors. There have been job losses. In 1988 there were 14,887 employed in 1989 there were only 14,425. The Cour des Comptes estimated that a fundamental restructuring of the Group is required, a reduction to 10 or 12 thousands jobs and the development of an industrial strategy. The Cour recommended *"la scission du GIAT en branches d'activités destinées à devenir des entreprises performantes, capables de participer à la constitution d'une industrie européenne dans leur domaine, voire d'être intégrées à des groupes existants"*. Thus a disaggregation of the Group, the constitution of new enterprises with or without agreements with other Groups and, possibly, privatization was recommended.

GIAT is a major European ordnance manufacturer (AMX 10, AMX Leclerc, armoured vehicles, small arms). Its initial organization was in three branches : munitions and pyrotechnics (37% of turnover in 1989), artillery and weapons (18%), armoured vehicles and turrets (45%). For the latter products GIAT Industries is in a monopolistic situation in France. It has concentrated national ordnance industries (Luchaire, Manurhin) and acquired most of the Belgian FN and FN Herstal in 1990. It co-

operated with RVI on wheeled armoured vehicles and tanks. It works now in the aerospace sector through co-operation with GE on helicopter arms and on anti-tank activities within the existing state-owned SERAT group, with Aérospatiale. It is planning to reduce jobs by 4000 in 1992. It has new programmes: autonomous precision-guided munitions (AGPM) with ADCO consortium, MACPED (area effect antitank mine) with Hunting (UK), DNAG (Germany) and Honeywell (USA); gun turrets for helicopters with General Electric and VBM (véhicule blindé modulaire) with CLI and RVI. In 1989, GIAT's turnover was close to 6.5 billion francs, (10 % exports) with 400 million francs in net income and 1 billion francs spent on R&D.

Matra Defense-Espace

Matra is a private company (100% MATRA S.A.), with two-thirds of its activity in the military sector. It produces missile components, naval missile and subsystems, drones, missile systems, aerial weapon and subsystems systems and satellites. It has four main subsidiaries, Fairchild Space and Defence Corp (bought in 1989), MS 2 I (Matra 65% - SEP 35 %), Matra-Marconi Space (51% Matra and 49 % GEC Marconi), SAT (22% Matra and 57 % SAGEM) and BGT in 1989 (Matra 20 % and Diehl 80%). It has also sold of Matra Manurhin Defence to GIAT and Manurhin to FN (Belgium). It is also involved in a number of co-operation programmes :

- DRONE BREVEL (EURODRONE), with Bremer Vulkan from Germany
- RM5 (Roland Mach 5) with EUROMISSILE
- HELIOS (military satellite), with Casa (Spain) and Selenia (Italy)
- HISPASAT (civil satellite) with BAe (UK), GEC Marconi (UK) and Fokker (Netherlands)
- MILAS (torpedo carrying missile) with Oto Melara (Italy)
- APACHE with Aérospatiale and
- MICASRAAM with GEC Marconi.

TABLE 50: MATRA

(in personnel units and million francs)						
Date	1985	1986	1987	1988	1989	1990
Personnel	5787	5814	5712	5586	5330	3300
With engineers	1944	2010	2100	2100	3500	
Turnover	5976	5972	6572	7020	7200	
Military turnover	4394	4045	4796	5021	4500	5000
Exports	4390	4518	4616	5380	5040	
Net income	105	110	165	154	N.A.	
R&D (without State)	900	1050				
Total R&D	1500	1500				

Sources: Annual Reports (data not consolidated). The comparisons between data are not possible because the defence and spatial activities were subsidarised in July 1989.

SNECMA

The State owned SNECMA (96,887% French State and 1.864% United Technology Corporation), which received a 3.5 billion francs increase in capital in 1989 and 1990, is the principal French turbine manufacturer. Its profits fall to nil in 1990, on increased turnover of 5%. It has five main subsidiaries, SEP (52% shares), Messier-Bugatti (79%), Hispano-Suiza (100%), SOCHATA (100%), CFM International (SNECMA 50%-General Electric 50%) It has international programmes, mainly with General Electric (CFM 56 family, CF 6 civil, THR civil), Rolls Royce (new supersonic motor NSM), Fiat et Ishikawajima (GE 90 with General Electric).

TABLE 51: SNECMA

(in personnel units and million francs)						
Date	1985	1986	1987	1988	1989	1990
Personnel	13707	13888	13659	13347	13727	
With engineers	1592	1657	1700	1679	1784	
Turnover	9404	10252	9357	10258	13450	14100
Military turnover	4200	4620	3600	4600	5700	5100
Exports	7316	8100	6711	7322	10200	
Net income	76	46	-410	-250	85	
R&D (without State)	1350	1610	1570	1500		
Total R&D	2328	2552	2344	2422	2888	

Sources: Annual Reports (data not consolidated)

Dassault Electronique

It is a defence electronic company owned by the Serge Dassault holding. Defence sales are depressed and there is a move to boost civilian activities. It is associated with I.B.M. in a new company DE31-Informatique (55% Dassault), Dassault Electronique aimed at integration of custom-built expert systems and complex databases.

TABLE 52: DASSAULT ELECTRONIQUE

(in personnel units and million francs)						
Date	1985	1986	1987	1988	1989	1990
Personnel	3978	4133	4198	4121	4109	4331
With engineers	2159	2273	2435	2460	2472	2646
Turnover	2678	3173	3712	4041	4112	4005
Military turnover	2139	2403	2831	3295	3173	2872
Exports of Armaments	871	948	730	1343	686	543
Net income	111	133	141	115	134	-43
R&D (without State)	300	320	205	211	222	280
Total R&D	600	640	975	1035		

Sources: Annual Reports (data not consolidated)

SNPE

La Société Nationale des Poudres et Explosifs is a public company (French State 100%) which produces ammunition and explosives, chemicals and advanced materials. It has been restructured with the acquisition in 1989 of Tuset (hunting ammunition), ATMC and Brunet Sicap (advanced materials) and the powder section of PRB from Belgium. It is involved in the co-operation programme (ARIANE V boosters, GIE G2P) for French strategic nuclear forces and consortium for composite explosives.

TABLE 53: SNPE

(in personnel units and million francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	6987	6896	6609	6201	6010	5741
With engineers						
Turnover	2847	2901	2837	2914	3110	3265
Military turnover	1300	1840	1700	1800	1800	1800
Exports					900	1151
Net income	-18	-36	-40	16	32	38
R&D (without State)	204	205	201	200	180	200
Total R&D	463	465	549	522	540	837

Source: Annual Reports (data not consolidated)

Turbomeca

Turbomeca is a producer of aeronautic turbine engines for helicopters. It is a main French sub-contractor for the arms industry. In 1987, it is included in the LABINAL group.

TABLE 54: TURBOMECA

(in personnel units and million francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	4288	4303	4293	3180	3883	3934
With engineers	523	561	608	599	384	425
Turnover	2027	2027	2154	2286	2370	2564
Military turnover	1400	1240	1400	1500	1600	1600
Exports	860	860	955	1125	1145	1264
Net income	28	72	45	72	115	118
R&D (without State)	209	230	284			
Total R&D	400	380	424	374	448	496

Sources: Annual Reports (data not consolidated)

SAGEM

It is a main private producer of naval and aeronautic navigation, guidance and pilotage systems.

TABLE 55: SAGEM

(in personnel units and million francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	8901	8107	7821	7744	7243	6392
With engineers	947	977	1118	1255	1234	1139
Turnover	4136	4472	4607	4761	4942	5153
Military turnover	1400	1590	1400	1900	1800	2100
Exports	1063	1035	1076	756		899
Net income	98	116	128	147	127	148
R&D (without State)						
Total R&D						

Sources: Annual Reports (data not consolidated).

Renault Vehicules Industriels (R.V.I)

RVI is a very important company, mainly concerned with civil products. It produces tank engines and armoured vehicles. Its financial performance is not disclosed but is probably loss making. It has increased its co-operation with GIAT on tanks parts and wheeled armoured vehicles.

TABLE 56: R.V.I.

(in personnel units and millions francs)

Date	1985	1986	1987	1988	1989	1990
Personnel	22861	21369	19216	18821	18762	18468
With engineers	1353	1212	1158	1113	1148	1270
Turnover	13776	13717	14663	17540	19289	18200
Military turnover	700	600	1400	1600		
Exports	5199	4639	4174	4852	5738	5472
Net income	-1541	-991	22	777	1015	-17
R&D (without State)			405	475	575	640
Total R&D						

Sources: Annual Reports (data not consolidated).

Sextant Avionique

Sextant avionique was created in 1989, with CROUZET, EAS, SFENA (subsidiary company of Aérospatiale) and avionic division of Thomson-CSF.(50% Aérospatiale and 50 % Thomson CSF holding owns 54% of Sextant Avionique, the remaining shares being publicly traded). It is the leading firm in Europe for avionics. Two-thirds of the production is for airborne instruments, radio communications, components for

space systems and automatic testing. One-third is for manufactured automation components, timers and terminals for electronic applications.

TABLE 57 : SEXTANT AVIONIQUE

(in personnel units and
million francs)

Data	1989	1990
Personnel	7464	7052
With engineers	1912	2186
Turnover	5055	5278
Military turnover	3938	2200
Exports	1343	
Net income	145	179
R&D (without State)		
Total R&D		

Commissariat à l'Energie Atomique

The Commissariat à l'Energie Atomique (CEA) was created on 18th October 1945 by Général de Gaulle and it was presented at that time as an indispensable tool for French nuclear and economic development. No nuclear military programme was developed until December 1954, when Pierre Mendès France expressed his commitment to a secret research project on nuclear weapons and atomic submarines. Major financial subsidies were then deducted from the Defense budget and transferred anonymously to the CEA without specifying their use. In the French case, civil nuclear R&D was very useful for nuclear weapons, not the opposite.

In 1986, the resources devoted to military and civilian nuclear purposes were almost equal, although it is difficult to quantify them very precisely, because of the inseparability of some civilian and military uses. There is a synergy between military and civilian research. The plutonium requirements for new French nuclear weapons programmes are not being met by the output of military reactors alone. Superphénix is therefore important, indeed essential, to support the technical base for France's "deterrence forces". Thus civil nuclear energy is still important for the military nuclear sector. Since 1962, military nuclear expenditure has probably exerted some positive action on civilian nuclear development in the fields of both fundamental and applied research (uranium supplies and fuel fabrication, enrichment, reprocessing, reactors, optimization of the PWR channel). From 1980 to 1988, greater importance was given to nuclear forces, with special support for tactical nuclear forces. In 1989, nuclear and space will absorb 34.2 per cent of payment allocations for defence equipment.

The French civilian nuclear industry is in crisis, as is the world civil nuclear industry. No orders for exports (except a contract signed in 1987 with China concerning the construction of the Daya-Bay power station), excess capacity, and social and political opposition are drastically reducing the potential of this industry, which was particularly representative of high technology in modern French growth. The crisis is perhaps a direct consequence of new developments in the military field. If civilian nuclear production is threatened because of proliferation and due to prohibitions on material and technology exports, military nuclear production is clearly accepted by public opinion. There is little possibility, however, of verifying what is exactly the right sum to spend on developing a deterrence strategy. Although the French nuclear industry is very competitive and is able to satisfy national demand, the military nature of nuclear production reduces the opportunity of important spin-offs from nuclear R&D. Thus the civil value of nuclear R&D is reduced, and perhaps, the latest French efforts in nuclear weapons can be seen as an industrial policy in response to the recession in the civil nuclear sector. The nuclear lobby is trying to obtain an increase in military nuclear public allocations in order to compensate for the decline in civil nuclear orders. But the 1992 budget forecasts a reduction of 3.3% of the nuclear forces allocation of expenditure. At the Commissariat à l'Energie Atomique, there is a Direction des Applications Militaires, which in 1991, will use about 50% of the total credits and employs 6,500 people (8,200 in 1968) including 2000 engineers.

NOTES

- 1 Kolodziej Edward (1983), "France" in **The Structure of the Defence Industry**. Edited by Nicole Ball and Milton Leitenberg, Croom Helm, London and Canberra.
- 2 There exists some professional unions with dual (civilian and military) use, such as GIFAS (Groupement des Industries Française Aéronautiques et Spatiales), GIEL (Groupement des Industries Electroniques), SPER (Syndicat des industries de matériel Professionnel Electronique et Radioélectrique) and CSCN (Chambre Syndicale des Constructeurs de Navires), which are controlled or highly influenced by the arms industries.
- 3 The data of the importance of arms manufacture under licence is interesting in order to establish the autonomy of the French arms production.
- 4 Decisions about international cooperation are analysed later in the report.
- 5 In 1985, Pierre Dussauge wrote: "La situation dans le secteur de l'armement est aujourd'hui presque stabilisée; il existe une répartition des activités entre quelques grandes entreprises qui disposent, chacune dans leurs domaines, d'un savoir-faire et d'une avance technologique qui en font, pour un type de matériel donné, le seul fournisseur possible... Dans le même temps qu'elle supprime la concurrence entre industriels française et qu'elle finance le développement des matériels, la DGA leur garantit un marché... La DGA joue un rôle important dans l'orientation de la demande exprimée par les Etats-Majors. Ce sont les directions opérationnelles de la DGA qui définissent le "champ des possibles qui s'offre, d'un point de vue technique, aux Etats-Majors, pour l'équipement des Armées... Par ailleurs, la DPAI définit, ..., les limites financières auxquelles se heurtent les différentes options techniquement possibles. On peut se demander si les besoins exprimés par les Etats-Majors ne sont pas très largement subordonnés à l'offre créée par la DGA... Il semble que le "catalogue" des programmes "industrialisables" est relativement limité, que les dossiers sont en permanence entre les mains de plusieurs décideurs - industriels, DGA., Etats-Majors, Ministres - et que la décision de lancer tel ou tel programme résulte largement d'un rapport de force interne au système qui se dégage, à un moment donné, en faveur dudit programme" (p. 36-37). These

assertions are now moderated by European and international cooperation solution.

- 6 This table is a synthesis given by the Reports of the CFRFA from 1970 to 1988. The publication of this report is postponed. Unfortunately, here is no new open source on this matter since 1988.
- 7 Delhombre Jean, "Exportation françaises d'armement et commerce extérieur". **Défense National**, Février 1990, pp. 66-67.
- 8 Brzoska M. (1989), "The structure of the arms production in Western Europe beyond 1992". ISA Conference, London, March-April 1989.

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