Assembly of Western European Union

DOCUMENT 1606 6 May 1998

FORTY-FOURTH SESSION

European naval cooperation – Frigate programmes

REPORT

submitted on behalf of the Technological and Aerospace Committee
by MM González Laxe and Arnau Navarro, Rapporteurs

ASSEMBLY OF WESTERN EUROPEAN UNION
43, avenue du Président-Wilson, 75775 Paris Cedex 16
Tel. 01.53.67.22.00 – Fax: 01.53.67.22 01
E-mail: aueo-aweu@calvanet.calvacom.fr
Internet. http://www.weu int/assembly/welcome html

Document 1606 6 May 1998

European naval cooperation – Frigate programmes

REPORT[1]

submitted on behalf of the Technological and Aerospace Committee[2]
by MM González Laxe and Arnau Navarro, Rapporteurs

TABLE OF CONTENTS

[1] Adopted unanimously by the Committee.

[2] *Members of the Committee*. Mr *Marshall* (Chairman); MM Lenzer, Atkinson (Alternate *Wray*) (Vice-Chairmen), Mrs Aguiar, Mr *Arnau Navarro*, Mrs *Blunck*, MM Cherribi, *Cunliffe*, *Diana*, Mrs *Durrieu*, MM *Etherington*, Feldmann, Hunault, Mrs Gelderblom-Lankhout, MM *López Henares*, *Lorenzi*, Luís, *Martelli*, *Olivo*, Polydoras, *Probst*, Ramírez Pery, Sandrier, Staes, Theis, *Valleix*, Mrs Zissi, N ...

Associate members: MM *Dincer*, *Kiratlioglu*, *Yurur*.

N.B. *The names of those taking part in the vote are printed in italics.*

Draft Recommendation

on European naval cooperation – Frigate programmes

The Assembly,

(i) Considering the increasing importance of naval armed forces in European security and defence;

(ii) Recalling in this connection WEU's contribution to the Gulf war and the embargo in former Yugoslavia;

(iii) Bearing in mind further that the Falklands war revealed navies' widespread vulnerability to missile attack, leading to new types of frigate design with enhanced anti-missile and anti-air warfare capability;

(iv) Recalling the NFR90 project, whereby various NATO countries tried to reach agreement on a common frigate design,

(v) Considering that European naval development can be achieved cooperatively, inside NATO, but taking European defence industry interests into account,

(vi) Welcoming the various frigate programmes currently under way in Europe, namely TFC (Trilateral Frigate Cooperation) between Germany, Spain and the Netherlands, and the Horizon programme, involving France, Italy and the United Kingdom,

(vii) Taking the view that cooperation must not be reduced solely to technical and industrial fields but should extend to tactical and operational areas;

(viii) Recalling in this connection the British Government's decision to make its operational sea-training facilities available to WEU for national or collective use by WEU countries, as the Birmingham Declaration confirmed;

(ix) Noting furthermore that the definition of a common concept as the basis for genuine cooperation of necessity requires identical scheduling,

(x) Stressing the importance attached to promoting a culture of cooperation within firms, preferably through involvement in programmes that are straightforward;

(xi) Considering finally that opening up Euromarfor to other countries wishing to join would constitute a very positive development for that organisation, in view of the fact that its *raison d'être* is bound up with the conduct of Petersberg tasks,

RECOMMENDS THAT THE COUNCIL

1. Set up a Naval Group along the same lines as the Space Group, the objectives of which might be, *inter alia:*

- to study the future naval requirements of WEU member countries, taking account of Petersberg tasks Such a study should cover frigates, corvettes, logistic support vessels, submarines, torpedoes, including weapons systems, naval patrol aircraft, marine helicopters and embarked reconnaissance UFVs;
- to bring schedules into line,
- to encourage naval cooperation at technical and industrial levels,
- to develop the Organisation's operational role through the use of existing training facilities,
- to encourage Euromarfor to open up to other countries,
- to promote naval training exercises conducted specifically with Petersberg tasks in view

Explanatory Memorandum

(submitted by MM González Laxe and Arnau Navarro, Rapporteurs)

I. Introduction

1. The term "frigate" was reintroduced into naval parlance by the British Royal Navy during the second world war to denote a mass-produced, long-range anti-submarine escort ship[1] More recently, in the 1960s and 70s, frigates acquired by most fighting navies around the world offered capabilities that could be described as generalist, without particular specialisation in a given combat area, or, in other words with limited capabilities in any area of combat.

2. The Falklands war in the early 1980s meant that the vulnerability of these types of ships and of navies in general to Exocet missiles and, by extension, to any anti-ship weapon, was laid bare – which led to a rethink about a new type of frigate

3. Thus the definition of the new concept for the frigate marked a return to the classic definition as the "smallest warship capable of independent deployment" and that in turn implied effective anti-missile and anti-aircraft capabilities as well as a reasonable anti-submarine defence capability

4. This gave rise to the NFR90 (NATO Frigate Replacement for the 90s) project which, although it succeeded in drawing the majority of NATO countries, nevertheless failed to get off the ground, as it proved impossible for such a large group of countries to reach agreement when it came to defining a common concept.

5 However this initial abortive attempt nevertheless sowed the seed from which Europe's two current programmes sprang. These are Trilateral Frigate Cooperation (TFC), a partnership between Germany, Spain and the Netherlands, and Horizon, which brings together France, Italy and the United Kingdom

6. These programmes, as will subsequently become apparent, are far from similar as regards the degree of cooperation involved between governments and industry, the technical specifications of the vessels, their weapons and radar systems and so on, and it is precisely that diversity which, in the Rapporteurs' opinion, makes their study and the reasons that led to the choice of a particular option the more interesting.

[1] *Naval forces*, 2/97.

II. Cooperation between Germany, Spain and the Netherlands

7 As has already been said, the NATO Frigate Replacement for the 90s (NFR90) ultimately came to grief in the late 1980s because it was impossible for the participant countries to reach agreement on the definition of a common concept. The same thing happened with the NATO Anti-Air Warfare System (NAAWS) programme, the purpose of which was to develop a local area missile system in conjunction with the NFR90

8. The demise of these programmes did not do away with the need various countries were expressing to procure frigates with air-defence capability. Germany and the Netherlands, joined later by Spain, therefore agreed on a new programme known as Trilateral Frigate Cooperation or TFC.

9. It was agreed right from the start of the cooperation programme that its purpose was not joint construction of vessels but obtaining the most cost-effective outcome in terms both of procurement and life-cycle cost. This left countries free to choose their own preferred solutions. This three-way cooperation is in fact confined to the ship's platform and does not extend to systems installed there

10. Cooperation therefore takes place in areas where it is possible and feasible, which meant that Spain was able to join the programme, although it is not involved in developing the Anti-Air Warfare System where cooperation is restricted to Germany and the Netherlands.

11. The cooperation agreement envisages each country building its own frigates to independent but largely homogenous design. Joint procurement has been agreed in some areas to secure the best prices and development costs are shared.

12 In January 1994 a memorandum of understanding (MOU) on the definition phase was signed by the three countries This phase was

undertaken independently by each of the partners although meetings were held at regular intervals during which attempts were made to hammer out solutions in common, joint specifications were produced, information exchanged and areas of cooperation identified

13. The TFC concept is therefore a project where each country builds similar ships with national variants, on the basis of partial cooperation and taking advantage of synergies produced through shared engineering experience, joint definition and procurement of equipment and specific collaboration over combat systems

14. The agreements reached on the definition phase have resulted in firm cooperation between the three governments on the basis of an MOU signed between their respective navies and industrial collaboration through agreements signed in September 1994 between ARGE (Germany), Bazán (Spain) and Royal Schelde (Netherlands) with a view to joint definition of equipment, cooperation over detailed platform studies and the framing of a joint strategy for shipyards for construction of the combat system

15 We shall now turn to discussion of the particular characteristics of each of the frigates, for which Germany has already signed a contract for three, with an option on a fourth, while Spain and the Netherlands are to build four vessels apiece.

Germany's F-124 frigate

16. Following cancellation of the NFR90 programme, in 1990 Germany and the Netherlands signed a Memorandum of Understanding on Naval Ship Cooperation (MOU NSC) which laid down the basis for cooperation between the two countries in the field of "naval research, development, procurement and life-cycle support, wherever the Nations identify a benefit from cooperation".

17 Frigate requirements, schedules and costs were reviewed over a two-year period to ascertain whether cooperation could be beneficial. During that time the definition changed from that of a multi-purpose frigate with special anti-submarine warfare capabilities to that of a frigate whose primary role was anti-air warfare cover for task force protection.

18. In this two-year long process (1992-93), Germany and the Netherlands identified a common need for frigates, harmonised their frigate requirements, defined a joint approach to the weapons and sensor suite, agreed a common superstructural layout for the frigates, giving rise to an almost identical design study, and an approach to the combat direction system (CDS) which made joint software production possible – resulting in effective cost-sharing with consequent reductions in each nation's costs and harmonised and synchronised schedules for frigate production.

19. In 1994, as stated previously, Germany, Spain and the Netherlands signed an MOU on common definition of their frigates According to the German authorities the underlying principle was to identify, during project definition, potential areas of cooperation likely to give rise to development work, draw up a joint procurement list of as many items as possible and agree a procurement programme for the three nations and, where appropriate, shares in any development work necessary.

20 The approach here consisted in agreeing common solutions as far as possible in terms of ship design, standards and rules and regulations, both in order to achieve real cost savings and avoid imposing overly specific solutions, working methods or other constraints In this way it was possible to put in place a highly cost-effective national construction process incorporating the maximum number of common elements

21 Germany formed a company to build the ARGE F-124 frigate consisting of Blohm und Voss GmbH, as the leading yard, Howaldtwerke-Deutsche Werft AG and Thyssen Nordseewerke GmbH

22 The outcome of the definition phase (1994-95) was as follows national procurement preparation in all three countries, joint specifications for items in common, thus allowing the various government organisations to set to work building frigates equipped in the same way, in the case of Germany and the Netherlands identical weapons, sensors, CDS and platform components, methods and technical standards, a common tendering process for identical items, joint development by Germany and the Netherlands of some components for the multi-function radar system (APAR or Active Phased Array Radar) and related fire-control software and for the AAW (Anti-Air Warfare) system including

integration of the SM-2 missile, development of the ESSM (Evolved Sea Sparrow Missile) with ten other NATO nations and further information and status exchanges between firms and governments.

23. The procurement process started in June 1995 with the signing of the contract for construction of the Dutch frigate, followed in March 1996 by Germany's F-124 frigate and the Spanish F-100 in February 1997 All procurement contracts secured parliamentary approval.

24. The MOU for the development of the APAR multi-function radar was signed by Germany, the Netherlands and Canada in 1995 and in 1996 the same three countries also signed the MOU for the AAWS with integration of the SM-2 missile Lastly, 1996 also saw the signature of the trilateral MOU between Germany, Spain and the Netherlands for the DD&C (design, development and construction) phase

25. The F-124 has a CDS (combat direction system) that uses a real-time database and integrated communications network with 17 multifunctional consoles and processors, 2 large-screen tactical displays, 12 bus interface units, a Cosmos monitor, a redundant databus and distributed processing

26 The F-124's anti-air warfare system consists of APAR – a multi-function, static-face radar with the latest in miniaturised, integrated transmit/receive modules, medium and long-range SM (Standard Missile)-2 Block IIIA anti-air missiles and, for the future, Raytheon and Hughes's ESSM although with a different guidance system to that used by the United States The missiles will be fired from a VLS MK-41 32-cell launcher The F-124 will also come equipped with two Rolling Airframe Missile (RAM) launchers and two quadruple Harpoon missile launchers and will carry a traditional Smart-L long-range radar.

27. The degree of cooperation over the air-defence system the countries involved in the trilateral programme maintain with the United States is striking. Apart from Spain's choice of the Aegis system, to be discussed in a later section of this report, other examples of such cooperation are the ESSM (Raytheon-Hughes), the MK-41 VLS, the SM-2 and related software, the SM-2 algorithms and software packages, all of which involve the three partner countries and the United States, and the RAM (Rolling Airframe Missile) involving the latter and Germany.

28. The F-124 will also have two triple MK-32 torpedo launchers and helicopter-borne long-range light-weight torpedoes. Additionally it comes equipped with an Oto Melara 76 mm gun and two Rheinmetal 20 mm guns.

29. The flight-deck and hangar accommodate two on-board NH-90 helicopters. The two hangars are separated by a passageway for fire protection The helicopters are supported by a fully-equipped and stocked maintenance workshop, a briefing room and helicopter handling equipment

30. The Helicopter Handling System from MBB-Forder und Hebesysteme uses laser-guided and computer-controlled manipulator arms to secure the helicopter after landing The system, handled by a single operator from a portable remote control handset, allows the helicopter to be transferred to a hangar without manual intervention The helicopter flight-deck is rated to accommodate a 15-ton class helicopter, such as a Merlin, for fuelling and torpedo loading

31. The F-124 uses a CODAG (combined diesel and gas) propulsion system. In diesel mode, the ship has an operating range of 4 000 nautical miles at a cruising speed of 18 knots In combined diesel and gas propulsion mode the ship can reach a maximum speed of 29 knots[2]

32 Lastly the ship's measurements are as follows. length: 131 5 m, beam: 16 5 m, displacement. 5 860 tons The ship has a complement of 243

Spain's F-100 frigate

33. The F-100 programme had its origin in the Alta Mar Plan which established the Spanish Navy's frigate requirement at 15 ships. Thus Spain was actively involved in the NFR90 programme until the latter was cancelled in 1989 owing to the complications of carrying out a project of that kind with such a large number of countries.

34 The F-100 programme started at that juncture. It sought to take advantage of the ex-

[2] *Website for the Defence Industry - Navy*
http: //www naval technology com/projects/f124/index htn

perience and know-how gained with the NFR90 project, by continuing the manifold progress achieved in the construction of Spain's second FFG frigate series – the Santa María F-80 Class (Navarra F-85 and Canarias F-86) [3] Thus, the aim was to take full advantage of Spain's industrial potential, and especially its military shipyards where Spain had notched up a number of notable successes.

35 In 1990 the Spanish Navy and the military naval construction yard, Bazán, began the prefeasibility phase and drew up the initial operating specifications for construction of four frigates of 3500-4000 tons This first study looked at various alternative solutions for the ship's platform, combat system, propulsion system etc. and ended up raising displacement to 4 500 tons to conform more closely to Navy requirements.

36. The study also revealed the need for external cooperation, with the aim of cutting down on technology risks and costs. Thus possibilities for European cooperation in specific areas like the combat system and equipment procurement were considered. Talks then began with Germany and the Netherlands (Spain's earlier partners in the NFR90) which were going ahead with their plans for new frigates and which, in the Spanish authorities' view, offered opportunities for flexible and hence more realistic and feasible cooperation.

37 In November 1993, the Bazán, Royal Schelde and Blohm und Voss naval yards signed an agreement to collaborate in the development and construction of the various ship's platforms, shortly afterwards the defence ministers of the three countries concerned signed the MOU on cooperation over the definition phase Moreover at the same time Spain's Indra group signed an agreement with the Dutch firm Signaal in connection with the APAR (Active Phased Array Radar)-based combat system being developed jointly by Germany, Canada and the Netherlands.

38 The F-100's definition phase ended in July 1995 and, from Spain's point of view, trilateral cooperation throughout that period was regarded as entirely satisfactory, both at government and industry level. However, during that phase the AAW (Anti-Air Warfare) segment was identified as the most complex part of the programme and the Spanish Navy decided that to adopt the APAR system, which, as noted previously, was then in the development phase, would introduce uncertainties over both costs and schedules Uncertainty over costs had no place in the Spanish tendering system under which programme costs had to be known from the outset while the prospect of a slippage in schedules militated against Spain's urgent need for new frigates within the shortest possible time-frame

39 In addition, Spain regarded as unacceptable the risks inherent in modifying the guidance system for the SM-2 missiles chosen for the F-100 frigate to make it compatible with APAR. It would basically have been necessary to run system acceptance trials and this would have held up the programme.

40 These various considerations led the Spanish authorities to pull out of joint development of the anti-air system with Germany and the Netherlands in June 1995 and turn their attention to a solution based on the US Aegis system This necessarily entailed extending the programme's definition phase for a further year in order to adapt it to the new anti-air system.

41. In March 1997 construction began of the four frigates, at a total cost of 280 billion Spanish pesetas, approximately 100 billion of which were earmarked for foreign procurement of equipment for which Spain does not have 100% home-grown development capacity or whose domestic manufacture in limited series would not be profitable

42 Net gains on joint production, trade-offs and technology transfers for this type of foreign procurement would be over 91%

43 Foreign industry involvement will mainly be concentrated on the combat system based, as stated, on the Aegis system, with Lockheed Martin as the main supplier. The Spanish industry will mainly be involved in the production of the ship's platform and specific equipment for the combat system

44. The review *Naval Forces*[4] opines that Spain's choice of Aegis for its two F-100 frigates represents a new phase in the system's evolution as an international programme, as the F-100's combat system includes Spanish sensors and

[3] *Revista Española de Defensa (RED)*, March 1997

[4] *Naval Forces* 1/1997/Vol xviii

weapons, a Spy-ID radar and a Spanish combat direction system. Thus Spain is the first country to produce major Aegis system components outside the United States.

45. In designing the combat system for the F-100, Spain looked to that of the US *Arleigh Burke* destroyer, adapting it to Spanish operational requirements. The aim of the process is to produce a home-grown operational command and control system, which, together with the Aegis system, would make possible total integration of all the sensor and weapons subsystems, irrespective of whether they were produced inside or outside of Spain.

46 Thus the main feature of the F-100 Combat Direction System is that it ensures easy, rapid interconnection between different types of on-board equipment, providing compatibility between those of Spanish and US manufacture Spanish companies involved in the production of the combat system are Indra, Sainsel, Fábrica de Artillería de Bazán (FABA) and Enosa

47. The combat system consists of four main segments[5]: an anti-aircraft system, the basic component of which is the Aegis system, responsible for the search, detection, identification and monitoring of targets, firing and guidance of anti-aircraft missiles and control of the interceptor aircraft themselves. The core of the system is the AN/Spy-ID three-dimensional long-range radar and the MK-99 illuminators for missile guidance. Weapons systems include the 48-cell MK-41 vertical launcher for the SM-2MR and ESSM short and medium-range missiles and a Meroka 2B gun combined with a RAN30L/K detection radar system.

48 The F-100's anti-submarine warfare segment consists of DE-1160 LF ship's sensors, helicopter-installed Lamps III SH-60B sensors (for Sikorsky SH-60 Seahawk helicopters) and MK-46-5 torpedoes capable of being launched from ship or helicopter

49 The F-100 is also equipped with a Harpoon surface-to-surface missile system and an MK-45 gun associated with a DORNA fire control system. This artillery assembly is designed to provide the vessels with better fire-power against coastal defences.

[5] *Revista Española de Defensa (RED)*, No. 119-120, 1998.

50 Finally, the fourth component of the frigate's combat system is its electronic warfare capability. The F-100 will have Elnath MK-9000 communications and an Aldebarán radar set and MK-36-2 chaff launchers

51. The vessel in its final version is quite different to that envisaged at the outset. It is now 133.2 m in length, with a beam of 17.5 m and displacement of 5 760 tons. It is fitted with a CODOG propulsion system giving it a maximum speed of just over 28.5 knots It will have a complement of 250. The F-100s are due to enter into service between 2002 and 2007

The Dutch LFC Frigate

52 In the 1980s the Netherlands Navy also joined the NATO Frigate Replacement for the 90s (NFR90) programme to design new air defence and command frigates, with the intention of using the new design to replace the two existing guided-weapon frigates, *Tromp* and *De Ruyter*. These ships act as AAW-platforms and command ships for naval task forces. The ships were designed in the 1960s and commissioned in the 1970s They are equipped for air defence with Signaal-manufactured 3D long-range air-surveillance radar and US-produced Tartar and NATO Sea Sparrow missiles.

53. The Netherlands also joined the NATO Anti-Air Warfare System (NAAWS) programme for the development of a local area missile system for the NFR90 The programme was to incorporate development of a multi-function radar, an agile short-range missile and an AAW core system

54 The NFR90 and NAAWS programmes collapsed at roughly the same time the Berlin wall fell and the Netherlands Navy was left with a requirement for new air-defence frigates and no programme with which to fulfil it. A new programme was therefore initiated in cooperation with Germany When Spain subsequently joined, it became known as Trilateral Frigate Cooperation (or TFC).

55 A decision was taken at the outset of the programme that its aim was not joint construction of ships but the pursuit of cost-effectiveness in terms both of procurement and life-cycle costs Each nation consequently retains the freedom to choose its own preferred solutions. However, where cooperation is possible and feasible it is of

course pursued. Hence Spain can continue to be part of the TFC-programme despite having opted out of the joint AAW-development

56 In the Netherlands the new frigates are known as Luchtverdedigings- en Commando-Fregatten or LCFs, which stands for air-defence and command frigates. The Netherlands is to build four such ships.

57. Germany and the Netherlands decided to cooperate on developing the AAW system in conjunction with the TFC programme A development contract for this integrated system was signed in June 1997 with the Netherlands as the contracting authority and Signaal as prime contractor.

58 The principal components of the joint AAW system are

- the APAR multi-function radar,
- a long-range infrared search and tracking system, known as Sirius,
- the Smart-L long-range air surveillance radar;
- the AAW software;
- the MK-41 vertical launch system used to fire both short-range Evolved Sea Sparrow missiles and medium-range standard missiles;
- two MK-31 guided missile systems for Rolling Airframe Missiles (in the German system only),
- two Goalkeeper systems (in the Dutch system only).

59 The development of the active phased array radar (APAR) is a multinational effort with the Dutch Government again as contracting authority and Signaal as prime contractor. Workshare subcontractors have been selected in the participating countries, Canada and Germany, on the basis of costshares

60. APAR development began in the latter half of the 1980s Following the demise of the NAAWS programme, a technology demonstrator for an X-band active phased array radar was built in the Netherlands. The programme, known as EXPAR, demonstrated the feasibility of the concept. APAR project definition started in mid-1993 and ended in late 1995 and the project has now entered its engineering and manufacturing development phase, due to continue until early 1999

61 APAR will be able to perform a number of functions simultaneously These comprise horizon search, a limited volume search, accurate tracking of over 100 air targets and provision of support to defending missiles through mid-course guidance and terminal illumination. The system is primarily designed to defeat very low-flying stealthy anti-ship missiles and very high-flying supersonic divers Apart from its air-defence functions, APAR will also have a role in surface warfare, carrying out surface search functions and providing fire control for the gun system.

62 APAR will be capable of use in both blue water and brown water operations Hence it will be a pulse Doppler system with a large bandwidth and high resolution. In terms of missile support, it will be capable of sending modulated uplink messages and providing interrupted terminal illumination. The system is capable of handling a number of engagements per face in the same time frame.

63 The Netherlands, in conjunction with Germany, is investigating how APAR should be used to control defending weapons against ballistic missiles The research was carried out by the Applied Physics Laboratory of the Johns Hopkins University with support from the US Navy and American missile contractors The antenna consists of four static faces providing 360° coverage Each plate consists of roughly 3 000 transmit/receive modules.

64 Sea Sparrow and SM-2 are semi-active homing devices However as active phased array radar is not capable of providing continuous wave illumination, a number of development programmes have been started with US Navy support. These should result in an X-band uplink system for the Evolved Sea Sparrow Missile and a special form of terminal illumination (interrupted continuous wave illumination) for both ESSM and SM-2. The SM already has an X-band uplink provision. Simulations, including 6-degrees-of-freedom simulations, have shown the feasibility of the concept and development is under way. The Hughes Company in San Diego is developing fire control software alongside this activity.

65 Smart-L was developed by Signaal under a Dutch government contract The design is based on the S-band Smart system in use on board the Dutch M and L and the German F-123-class frigates. Under the terms of the development contract, Signaal will deliver a pre-production model. Factory acceptance of the PPM took place last year with satisfactory results Smart-L will be used as a volume search radar and to carry out fighter control on board air-defence and command frigates.

66 Smart-L is an L-band long-range pulse Doppler surveillance radar. Like APAR, its design is optimised for defence against low-flying, low-observable threats and very high-flying targets in a coastal environment The system can detect very small targets and, owing to that capability, Smart-L could detect birds as real targets, which is a problem in a littoral environment. Therefore the system is equipped with a filter based on the Doppler spectrum to eliminate bird contacts

67 The antenna consists of 24 horizontal linear arrays, each consisting of 48 dipoles Of those 24, only the top 16 are used for transmission On reception, the 24 arrays are used to create 14 stacked beams to provide altitude information. Under normal operation the system emits a fan beam, while under jamming conditions it can emit a narrow high-power burn-through beam. It therefore also has a part to play in ballistic missile defence, as this type of beam can be emitted up to even higher elevations

68. The Netherlands cooperates with Canada in the development of Sirius Canada acquired substantial experience through the joint development with the United States of a system known as AN/SAR-8 and the Netherlands has learned a good deal from the development of the IRSCAN-system. The Sirius system has two optical heads

69 As part of the AAW system Sirius will perform several tasks. it will supplement APAR under adverse radar conditions; it will provide continuous horizon coverage and, by providing accurate angle measurements, will be a major asset in the fusion of sensor data on low-flying targets; and under conditions of radar silence, it will obviously provide passive surveillance

70 At the present time a pre-production model is under contract Delivery is envisaged for the second half of next year when a programme of both warm and cold-weather land and sea-trials will begin.

71. According to a Netherlands Defence Ministry statement, total procurement costs for the four Dutch Navy LCF frigates will be 1.61 billion dollars[6] Contracts for the vessels, which are to be built by Royal Schelde, were signed in June 1995 and February 1997.

72 The Royal Netherlands Navy (RNLN) will procure and integrate the various components which are to form the LFC's sensor, weapons and command system The RNLN Centre for the Automation of Weapon and Command Systems will develop the required software and Royal Schelde will install the sensor, weapons and command system on board

73 McDonnell-Douglas Harpoon anti-ship missiles are already on order through Foreign Military Sales, while refurbished ex-Canadian Navy 127 mm main guns are being ordered from Otobreda Other major weapons systems such as the SM-2 Block IIIA and ESSM are being procured separately.

74 The LCF will measure 130 2 m in length and 16 9 metres in breadth, with a displacement of 5 840 tons, and it will have a CODOG propulsion system

III. Cooperation between France, Italy and the United Kingdom

The Horizon programme

75 France, Italy and the United Kingdom were also involved in the NFR90 programme designed to meet the requirement of many western navies for a frigate with effective anti-aircraft capability The project collapsed, as stated previously, basically because the variation in the requirements of the participant countries compromised the viability of the project, particularly in financial terms.

76 Nevertheless the existence of certain objective needs, the pressure of cut-backs in defence budgets both on account of the economic climate and owing to the demise of the Soviet bloc, led initially to France and the United Kingdom, joined shortly after by Italy, to consider the

[6] *Jane's Defence Weekly*, 23 July 1997.