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DISCUSSION PAPER ON THE INSTITUTIONAL OPTIONS FOR VMS COOPERATION AMONG THE PARTIES TO THE CONVENTION ON THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

Prepared by the Interim Secretariat[1]

SUMMARY

The discussion paper reviews the basis for VMS in international law and in terms of the Convention. The scope and operational arrangements for VMS made by regional fisheries organisations are described and the key differences and points of interest highlighted.

As a basis for further discussion, the institutional approaches to building a WCPFC VMS are suggested. Technical, legal and procedural issues are identified, which require further analysis and deliberation among the Contracting Parties.

Examples of measures and regulations governing VMS arrangements at a multilateral level are appended.

[1] Prepared by Kieran Kelleher, Consultant, fishybiz@indigo.ie

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ABBREVIATIONS

VMS	Vessel Monitoring System
FFA	Forum Fisheries Agency
NEAFC	Northeast Atlantic Fisheries Commission
FAO	Food and Agriculture Organisation
EU	European Union
EC	European Commission
ALC	Automatic Location Communicator = VMS unit
FMC	Fisheries Monitoring Centre

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1. INTRODUCTION

The purpose of this document is:

- to briefly describe the use of vessel monitoring systems and the legal basis for VMS;
- to describe the different institutional structures and arrangements with regard to international cooperation on VMS;
- to identify options for VMS cooperation arrangements among the Parties to the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention);
- to identify issues which must be addressed in defining the VMS system to be adopted by the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Commission); and
- to outline a roadmap for development of VMS cooperation among the Parties.

This discussion paper does not prescribe the system to be adopted. It merely presents selected questions, issues and options that should be considered when establishing a regional VMS. It does not purport to be exhaustive in its coverage of questions and issues involved, but attempts to highlight links between technical, institutional and legal dimensions of such a regional system. The opinions, suggestions and assumptions set out in the paper are not necessarily representative of all stakeholder perspectives and need critical appraisal and examination.

1.1. SCOPE OF THE DISCUSSION PAPER

Under Article 24 of the Convention, the vessels of member states are required to operate a satellite-based position-fixing vessel monitoring system. The Commission will operate such a VMS for all vessels fishing on the high seas.

VMS is essentially a system of communication. A variety of different types of information can be communicated from the fishing vessel to the fisheries authorities, including:

- reports of the vessel's position with a time stamp;
- catch reports, or reports of fish quantities on board;
- scientific information, such as water temperature;
- status of the fishing gear, i.e. setting, or hauling of lines, or nets as relayed from sensors on winches, motors, or other gear components; and
- video information, such as images of sorting fish on deck.

This paper focuses primarily on the use of satellite technology to communicate vessel position information as required under Article 24 of the Convention and the institutional arrangements for sharing such information. The paper does not address technical aspects of VMS.

In the future the Commission may require sharing of other types of information. It is assumed that such additional shared communications will constitute changes of information content and are unlikely to alter the fundamental institutional arrangements for VMS. This paper does not address the use of other satellite communication media, or the use of satellite-based radar imagery for remote detection of fishing vessels and their operations.

1.2. TERMINOLOGY

Over 50 countries around the world are using VMS for monitoring fishing activities. Over 6,000 vessels are being monitored, either by fisheries administrations, or by fleet managers.

The following terms are used:

Vessel Monitoring System (VMS). The term 'VMS' is used to refer to the system of transmission by satellite of the coordinates of a fishing vessel's position at a time and date to a fisheries administration. If other types of information are transmitted via satellite, e.g. catch on board, this is referred to in the text.

Fisheries Monitoring Centre (FMC). The term 'FMC' refers to the unit within the government administration that receives, analyses, and if necessary, retransmits the VMS information received from a fishing fleet. FMCs can be operated by the fisheries authorities, by parastatals, coast guards. or military.

VMS unit. This means the equipment that transmits the position information from on board the fishing vessel. It is also referred to as a Vessel Locator Device (VLD) in the FAO terminology and as an Automatic Location Communicator (ALC) in FFA terminology.

2. LEGAL AND INSTITUTIONAL BASIS FOR VMS

2.1. LEGAL BASIS FOR VMS AT GLOBAL LEVEL

At the international level, the legal basis for VMS rests on the United Nations Convention on the Law of the Sea (LOS Convention) and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA). Both of these instruments are referred to in the preamble of the WCPFC Convention.

Under the LOS Convention:

- coastal states have general duty to conserve, manage and utilize in a sustainable manner the living resources of the EEZ (Article 61.2)
- states shall cooperate in the conservation and management of the living resources of the high seas (article 118)
- states shall contribute and exchange available data relevant to the conservation of fish stocks through competent international organizations (Article 61.5 – EEZ and Article 119.2 -high seas)
- coastal and flag states shall seek to cooperate on the conservation of straddling stocks (Article 63 (2))
- coastal and flag states shall cooperate on the conservation and management of highly migratory species (Article 64)
- flag states have responsibilities for their fishing vessels operating on the high seas and shall effectively exercise jurisdiction and control over such vessels (Articles 94 and 117)

The UNFSA makes specific reference to establishing appropriate cooperative mechanisms for effective MCS and enforcement (Article 10(h)). The UNFSA also sets out requirements for the collection and sharing of fisheries and vessel data. States have obligations:

- to collect and share data concerning fishing activities, including on vessel position (Article 5(j));
- promote and conduct scientific research and develop appropriate technologies in support of fisheries management (Article 5(k));
- to implement and enforce conservation and management measures through effective MCS (Article 5(l));
- to ensure that their vessels collect and supply accurate information as required by RFMOs (Article 14); and
- with respect to recording and timely reporting of relevant fisheries data (vessel position, catch, effort) (Article 18.3 (e)); and

- development and implementation of VMS, including, as appropriate, satellite transmitter systems (Article 18.3 (g) (iii)), in accordance with schemes agreed at regional level.

Annex I of the UNFSA focuses on the 'Standard requirements for the collection and sharing of data':

- States or regional fisheries management organizations (RFMOs) should use VMS as a tool for position verification.
- Data collected by flag states must be shared with other states through appropriate RFMOs.
- RFMOs, when making data available, shall maintain confidentiality of non-aggregated data.

Other international instruments which make reference to VMS include: the Code of Conduct for Responsible Fisheries (CCRF); the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993) (the Compliance Agreement); and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA / IUU). The CCRF provides that states should implement effective MCS and law enforcement measures, including, where appropriate, vessel monitoring systems (Article 7.7.3). The IPOA/ IUU states that countries, where appropriate, should require vessels to carry VMS on board, in accordance with national, regional, or international standards (Article 24.3).

Under the 1993 FAO Compliance Agreement:

- States shall ensure that their flag vessels provide information on their fishing activities, including on area of fishing operations (Article III.7)
- States are required to exchange information, including evidentiary material relating to activities of fishing vessels (Article V.1).

It is clear that foreign vessels carrying out fishing operations can be subjected to VMS requirements by the coastal state. It is also clear that on the high seas vessels are subject to the exclusive jurisdiction of the flag state (Article 92.1). The requirement for support vessels to carry VMS may be disputed. It may be difficult to distinguish between a cargo vessel and a reefer vessel under international law, in particular if the reefer is under a non-Party flag. In such cases provisions may be required to prohibit vessels from transshipping catches (or using support vessels) flagged in non-Party states that fail to cooperate with the Commission.

2.2. REGIONAL WCPFC CONTEXT

Working Group III of the Preparatory Conference is charged with the development of standards, specifications and procedures, consistent with the Convention, including article 24, for the operation of a vessel monitoring system (WCPFC/PrepCon/13 and WCPFC/PrepCon/WP.6). Article 24 (24.8, 24.9 and 24.10) makes specific reference to VMS (see following Box).

Box 1. Convention Articles referring to VMS (Articles 24.8, 24.9 and 24.10)

24.8. Each member of the Commission shall require its fishing vessels that fish for highly migratory fish stocks on the high seas in the Convention Area to use near real-time satellite position-fixing transmitters while in such areas. The standards, specifications and procedures for the use of such transmitters shall be established by the Commission, which shall operate a vessel monitoring system for all vessels that fish for highly migratory fish stocks on the high seas in the Convention Area. In establishing such standards, specifications and procedures, the Commission shall take into account the characteristics of traditional fishing vessels from developing States. The Commission, directly, and simultaneously with the flag State where the flag State so requires, or through such other organization designated by the Commission, shall receive information from the vessel monitoring system in accordance with the procedures adopted by the Commission. The procedures adopted by the Commission shall include appropriate measures to protect the confidentiality of information received through the vessel monitoring system. Any member of the Commission may request that waters under its national jurisdiction be included within the area covered by such vessel monitoring system.

24.9. Each member of the Commission shall require its fishing vessels that fish in the Convention Area in areas under the national jurisdiction of another member to operate near real-time satellite position-fixing transmitters in accordance with the standards, specification and procedures to be determined by the coastal State.

24.10. The members of the Commission shall cooperate to ensure compatibility between national and high seas vessel monitoring systems.

Several other Articles are of relevance to the establishment of the VMS system:

- Article 8.1, Compatibility of management measures
- Article 10. Functions of the Commission
- Article 23. Obligations of members, and
- Article 30. Special requirements of developing States

Box 2. Article 8. Compatibility of conservation and management measures

1. Conservation and management measures established for the high seas and those adopted for areas under national jurisdiction shall be compatible in order to ensure conservation and management of highly migratory fish stocks in their entirety. To this end, the members of the Commission have a duty to cooperate for the purpose of achieving compatible measures in respect of such stocks.

The Commission shall take into account …
2. (b) (ii) previously agreed measures established and applied in respect of the same stocks for the high seas which form part of the Convention Area by relevant coastal States and States fishing on the high seas in accordance with the 1982 Convention and the Agreement;

2. (c) take into account previously agreed measures established and applied in accordance with the 1982 Convention and the Agreement in respect of the same stocks by a subregional or regional fisheries management organization or arrangement;

Article 8.1. The VMS measures taken by the members of the Commission must be compatible with each other and with the VMS measures take by the Commission with respect to the high seas areas. The areas of compatibility may include:

- the standards for the VMS units, including provisions to prevent falsification of position data and the means of inspection and approval of the on-board equipment;
- data formats and protocols for data exchange;
- penalties and measures to be taken if flag vessels fail to comply with the VMS measures; and
- confidentiality of the VMS data.

Article 10. Functions of the Commission. Allocation and control of effort on the basis of VMS information is done in several fisheries including in the EU, in the Gulf of Maine. Such measures may also be of use to the Commission: '…(g) develop, where necessary, criteria for the allocation of the total allowable catch or the total level of fishing effort for highly migratory fish stocks in the Convention Area;

(i) establish appropriate cooperative mechanisms for effective monitoring, control, surveillance and enforcement, including a vessel monitoring system;'

Obligations of members. Under Article 23 'Each member of the Commission shall: (a) provide … to the Commission … such data and information as the Commission may require;'

Developing states. Article 30.4 (c) recognises the special requirements of developing States with respect to: 'monitoring, control, surveillance, compliance and enforcement, including training and capacity building at the local level, development and funding of national and regional observer programmes and access to technology and equipment'.

Other recommendations of Working Group III of relevance to the VMS system include:

- 'Develop guidelines for creation of national vessel registries (Article 24(4)) and the regional vessel registry (Article 24(7)).' Clarity regarding vessel identity is fundamental to a VMS system.
- 'Develop guidelines for regulating and monitoring transshipment (Article 29 and Article 4.1 of Annex 3).'

2.3. VMS SYSTEMS OF THE PARTICIPANTS IN THE CONFERENCE

This section provides a short summary of the state of VMS in the countries of the Convention signatories and countries that participated in the Conference. The information presented is indicative only. Working Group III can compile more comprehensive and accurate information in due course.

Australia and New Zealand. Australia participates in the FFA VMS with respect to tuna vessels fishing in the FFA area. Australia, or Australian States operates several additional VMS systems for trawl and other fisheries. The VMS regulations are tailored to each specific fishery. For example, the Queensland trawl fishery is partly located within the Great Barrier Reef Marine Park. The VMS monitors the fishing activities of approximately 500 vessels in relation to 150 different closures (areas and time periods). The on-board equipment used complies with FFA type approval.

Eight New Zealand vessels comply with the FFA VMS requirements. An additional 50 vessels use Argos in several non-HMS fisheries.

China. VMS is not used for control of the domestic fleet. High penalties for fishery violations and closed season regulations are used to good effect. VMS used by the distant water fleet complies with the requirements of the coastal states. Chinese vessels are understood to be equipped exclusively with Inmarsat C.

Chinese Taipei. Distant water vessels transmit VMS data directly both to the coastal state and to the tuna fisheries association(s). Approximately 600 distant-water tuna vessels fishing in all oceans are involved. Approximately 60 vessels operate in the Southern Bluefin fishery. There are 41 tuna purse seiners under the Chinese Taipei flag. An additional 26 foreign-registered purse seiners may be owned, or operated by persons, or companies based in Chinese Taipei. Most, if not all of these vessels operate in the Pacific. An estimated 66% of the vessels use Argos, the remainder use Inmarsat C. Some vessels are equipped with both Argos and Inmarsat C. The Taiwan Deep Sea Tuna Boat-Owners and Exporters Association represents the vessel owners in access negotiations.

France and the UK. VMS used in Metropolitan France and in the UK complies with the EC requirements (see below). The French Fisheries Monitoring Centre (FMC) can thus interpret VMS signals from both Argos and Inmarsat C terminals. New Caledonia and French Polynesia are understood to require foreign fishing vessels to fit and operate the Argos vessel tracking system as a condition of licence for vessels fishing within their respective EEZs.

Indonesia. In the first phase the Indonesian fisheries authorities are installing an Argos VMS to track 1,500 vessels and are currently installing the VMS units in an initial group of 300 vessels. It is planned to expand the VMS coverage to another 2,000 vessels. A clearer profile of the Indonesian tuna fleet will emerge from an inventory being carried out by the Indonesian authorities and the IOTC and through the VMS project. In the interests of compliance with international norms, operators of large-scale tuna longline vessels (> 130 GRT, or > 24m and equipped with modern freezing equipment) are recommended to join the Association of Tuna Indonesia (ASTUIN).

Japan. Japanese distant water vessels use both Argos and Inmarsat C. The 239 Japanese flag vessels licensed to fish in the EEZs of FFA members comply with the VMS requirements of each FFA member. Approximately 750 Argos VMS units are installed on Japanese vessels. The Federation of Japan Tuna Fisheries Cooperative Associations plays an important role in coordinating the activities of the tuna fleet.

Republic of Korea. Information is not available. The 35 Korean flag vessels licensed to fish in the EEZs of FFA members comply with the VMS requirements of each FFA member. The Korean Ministry of Fisheries has an Argos FMC to monitor vessels in the Pacific and in the vicinity of the Russian Federation and Antarctica. About 250 vessels use Argos VMS units. The Korea Deep Sea Fisheries Association coordinates the activities of the distant water tuna fleet.

Pacific Islands. Jointly, Vanuatu and Fiji account for over 100 vessels on the FFA VMS register. Vanuatu requires all commercial tuna fishing vessels to be tracked by VMS at a minimum of 4 polls per day.

Republic of the Philippines. The Philippines has carried out trials with Argos. VMS is not used at the level of the fisheries administration. The 47 Philippine flag vessels licensed to fish in the EEZs of FFA members comply with the VMS requirements of each FFA member.

United States of America. VMS in the US is mandated on a fishery-by-fishery basis. It is generally used to enforce prohibited area regulations. VMS is used in the Hawaii longline fishery (approximately 145 vessels) to prevent fishing in close proximity to the Hawaiian Islands. Its use has been shown to be particularly cost effective in this fishery. The 21 U.S. purse seiners licensed under the U.S. Multilateral Treaty are in good standing on the FFA VMS Register. The U.S. has indicated that it intends requiring these U.S. purse seiners to provide automatic position reports to the U.S. domestic VMS sometime in 2004. Administrative matters are delaying the implementation of this proposed arrangement. Inmarsat, Argos and Boatracs VMS are used in Alaskan and US west coast fisheries. Approximately 650 Argos units are operating in US and Canadian west coast fisheries.

3. MULTILATERAL ARRANGEMENTS FOR VMS COOPERATION

3.1. TYPES OF INSTITUTIONAL ARCHITECTURE

Three different types of institutional arrangements for VMS cooperation can be identified in regional fisheries organisations:

- Peer-to-peer VMS data exchange. The fisheries authorities of two, or more countries agree to share, or swap VMS information in accordance with agreed procedures. The arrangements made under the Common Fisheries Policy (CFP) provide an example. Similar VMS cooperation occurs under several EU bilateral fisheries agreements.
- A centralised VMS service for foreign fishing in coastal state EEZs. The FFA provides an example of this arrangement.
- A centralised VMS service applied to high seas. Examples are the NAFO and NEAFC arrangements.

A range of institutional arrangements in regional fisheries organisations is described below. Each responds to the particular requirements of the specific fisheries and also reflects the historical evolution of these fisheries. In each case the VMS should be seen as an integral part of a management regime, complementing other conservation and control measures. In each case the utility of the VMS is closely linked and dependent upon the other elements of the management regime. These include fishing vessel registers, catch reporting, catch documentation, port inspection, observer schemes and sea-going surveillance.

Maps of the regulatory areas and copies of selected VMS-related measures approved by the regional fisheries organisations are appended in the Annex.

3.2. VMS UNDER THE COMMON FISHERIES POLICY (EU)

In accordance with Article 22 (1b) of EC regulation 2371/2002 all fishing vessels exceeding 18 meters in length overall must have installed onboard a fully functioning Vessel Monitoring System unit from 1 January 2004. This requirement will also apply to vessels exceeding 15 meters in length overall from 1 January 2005. Approximately 4,000 vessels are involved.

The EC regulations apply to member countries, not directly to individuals. National legislation obliges vessel owners to comply with the EC regulations. Under EC legislation each member country is obliged to have an operational Fisheries Monitoring Centre (FMC) which will receive VMS position and other information from its flag vessels and from other vessels fishing in its EEZ. EC legislation is enforceable through the European Court of Justice. Member states which do not ensure adequate compliance with the VMS regulations can face fines, or other penalties.

The type of VMS unit installed must be in compliance with the rules laid down in Commission Regulation (EC) No 1498/97. It must be tamper-proof and ensure the automatic transmission to the Fisheries Monitoring Centre of the flag state, at all times, of data relating to:

- the vessel identification;
- the most recent geographical position of the vessel, with a position error which shall be less than 500 meters;
- with a confidence interval of 99%; and
- the date and time of the fixing of the position of the vessel.

Unique feature. The unique feature of the EU VMS is the automatic re-transmission of VMS position information between member states. When a vessel moves from the EEZ of one member state to another, the software in the flag state FMC automatically copies this position information to the EU coastal state FMC. The VMS information is also available to the Commission. The data formats and services of numerous satellite service providers are harmonised within this integrated VMS data exchange system. The providers include: Argos, Inmarsat, Emsat and Euteltracs.

Reciprocal fisheries access agreements. The EC enters into two different forms of bilateral fisheries access agreements under which VMS information is transmitted to coastal states. Reciprocal agreements are concluded with Norway, Faeroes, Iceland and other North Atlantic countries. Under reciprocal agreements the VMS information is automatically transmitted between the parties in essentially the same manner as between EU member states. Thus, for example, when EU vessels enter Norwegian waters, the EU flag state automatically transmits the vessel position information to the Norwegian FMC and Norway reciprocates with respect to it its vessels when they are fishing in the waters of EU states.

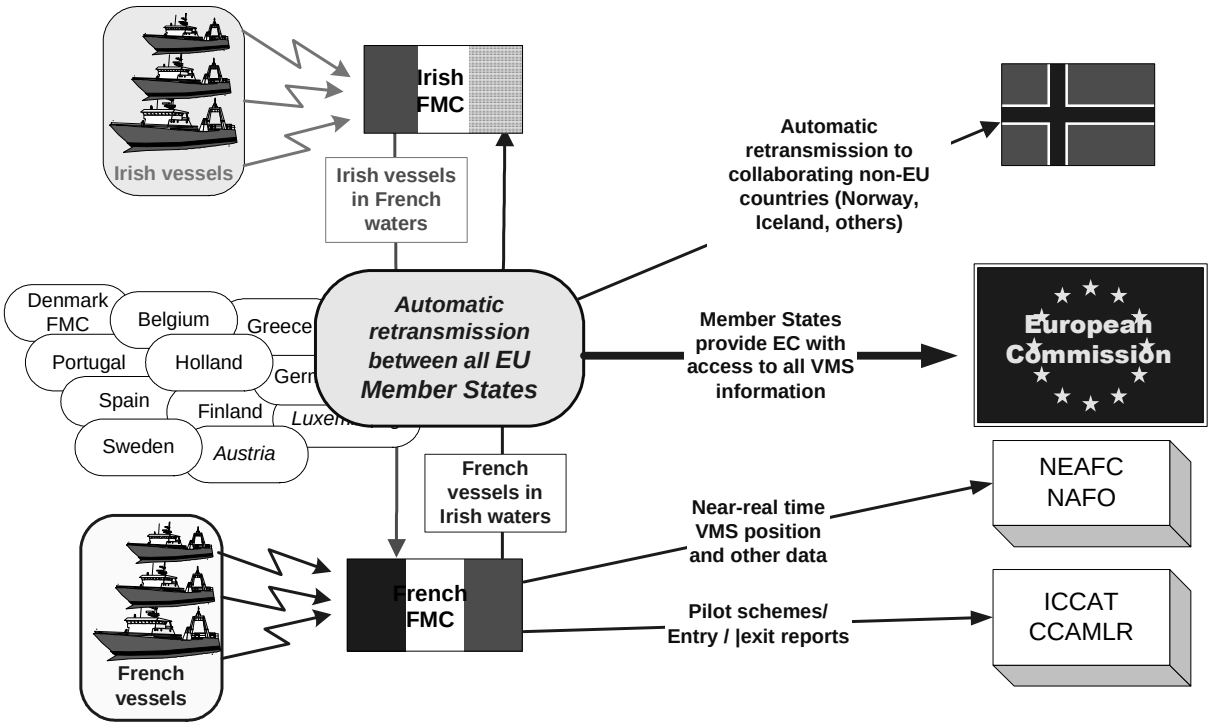

Figure 1. Diagrammatic representation of VMS in the EU

Access agreements with compensation. Comoros, Seychelles, Senegal and a number of other countries have access agreements whereby the EC makes a payment for fishing rights. Under some of these agreements there is an obligations upon the EU to provide VMS position information to the coastal state when the EU flag vessels are in the coastal state EEZ. However, partly because of lack of coastal state VMS facilities these provisions may not be implemented. In some cases VMS position information has been provided on paper rather than in electronic form. Exceptions are Seychelles and Kiribati. Under the EC agreement with Kiribati, EU vessels must be in good standing on the FFA VMS Register. Position information is sent directly via the Perth, Australia LES to the FFA VMS hub-site at Honiara, Solomon Islands, i.e. the VMS information does not pass through the intermediary of the flag state (Spanish) FMC.

Entry, exit, catch information and other communications. In certain fisheries or in areas where fishing effort controls are applied EU vessels may be obliged to report 'entry to the area', exit from the area' and 'catch on board' by VMS. VMS may also be used to arrange for inspections of vessels prior to the time a vessel exit an area (see NEAFC below).

VMS cooperation with regional fisheries organisations. As members of various regional fisheries organisations, VMS information is transmitted to several RFOs from the EC, from EU member states, or directly from EU flag vessels. The RFOs include CCAMLR, FFA, NEAFC, and NAFO. Further details of this cooperation are provided in subsequent sections.

3.3. NORTHEAST ATLANTIC FISHERIES COMMISSION (NEAFC)

NEAFC has a sophisticated and advanced system of VMS cooperation between members. NEAFC's area of competence is FAO Area 27, the Northeast Atlantic. The Regulatory Area of NEAFC comprises three high seas enclaves in FAO Area 27 (see map in Annex). The Commission recommends management measures including TACs for the high seas fisheries. An objection procedure applies. As the range of many of the managed fish stocks extends outside the Regulatory Area, there is close cooperation with NAFO (see below). Under a memorandum of understanding, ICES provides scientific advice to NEAFC.

VMS position reporting. VMS is obligatory for Contracting Party vessels over 24m in overall length fishing in Regulatory Area. The vessels automatically transmit position information (to within 500m, 99% confidence) to their flag state FMC, which re-transmits to the Commission. The FMC re-transmission is automatic which means that NEAFC receives the information in near real time. Position information is transmitted at least 2-hourly within the Regulatory Area. There are provisions for alternative reporting in the case of faulty, or non-functional VMS equipment.

Communication with surveillance assets. NEAFC automatically forwards position and catch information to the Parties' fishery patrol vessels that are active in the Regulatory Area. Patrol vessels of the Parties are authorised to board and inspect fishing vessels of other Parties.

Catch reporting. Quantities of fish on board must be communicated either to the flag state FMC, or NEAFC on entry to and exit from the Regulatory Area. Similar provisions apply to transhipment. Weekly catch reports are also required. Transmission of catch reports may be either by VMS, or other approved means. Pilot schemes to use VMS for catch reporting are operational in the case of vessels equipped with suitable equipment.

Unique feature. Under the pilot scheme, fishing vessels transmit 'catch on board' information one hour prior to entry to/ exit from the Regulatory Area. The NEAFC Secretariat automatically forwards this information to patrol vessels in the area. The patrol vessel, via the NEAFC Secretariat and the FMC, may instruct a vessel to remain in the area, or stop fishing for a period of 6 hours pending an inspection.

Data security. NEAFC's detailed provisions for VMS and other data security are appended in the Annex.

3.4. NORTHWEST ATLANTIC FISHERIES ORGANISATION (NAFO)

The NAFO area embraces both high seas areas and EEZs (Canada, Greenland, France, USA). However the 'Regulatory Area' is restricted to the high seas area within FAO Statistical Area 21. The regulated species exclude tunas and salmon. The Commission proposes and adopts international measures for control and enforcement for the fisheries within the regulatory area and allocates the catches between the members. NAFO regulatory measures are subject to objection procedures.

VMS. VMS pilot projects have been undertaken by NAFO.The NAFO VMS regulation is given in the Annex. NAFO regulations require that vessels operating in the Regulatory Area be equipped with a VMS. The VMS unit must report position every 2 hours to an accuracy of 500m, with a confidence interval of 99%. The obligation is on the FMC of the contracting party (NAFO member state) to retransmit the VMS position data to NAFO. There are various provisions for faulty VMS units. The NAFO secretariat makes VMS position data available to fisheries authorities that have a patrol vessel, or patrol aircraft in the regulatory area. All VMS data is confidential. Rules and regulations govern data use and dissemination. The Contracting Parties are responsible for the costs associated with the VMS. NAFO must be informed electronically of the catch on board the vessel when entering and exiting the regulatory area and of transhipment operations.

3.5. FORUM FISHERIES AGENCY (FFA)

The FFA Secretariat manages and administers the FFA VMS on behalf of the 17 FFA members. The FFA has been given clearly defined operational responsibility for VMS by the Member States. FFA has no requirements of its own in relation to the FFA VMS, since the requirements are enshrined in the national legislation of each of the FFA members. The FFA system deals only with tuna fishing vessels and support vessels. The licensing conditions of all FFA members with respect to foreign fishing vessels conform to harmonised minimum terms and conditions of access agreed by all FFA members. Under the Harmonised Minimum Terms and Conditions (MTC) for Foreign Fishing Vessel Access, VMS is a requirement for all foreign vessels fishing in the EEZs of the FFA members. There

is ongoing harmonisation of the countries' legal frameworks regarding the complex legal issues associated with VMS.

The VMS Register. The VMS is implemented through a process of application for good standing on the Regional VMS Register. The good standing status requires that the vessel be equipped with a VMS unit (referred to by the FFA as an Automatic Location Communicator, or ALC), which meets the specification set out by FFA. FFA only accepts transmission via Inmarsat C. The VMS units approved by FFA undergo a type approval process, which includes the installation of the VMS units by approved suppliers. Not all FFA members have licence conditions requiring that reefer, bunker and support vessels need to be in good standing, i.e. in some jurisdictions these vessels may not necessarily be required to report position by VMS.

Total number of vessels on the FFA VMS register of which	921
- vessels flagged in FFA member and fishing outside flag EEZ	146
- vessels flagged in non-FFA WCPFC signatories	702
- other flag, including flag of convenience and non-Pacific coastal states	73

See table in annex for details by country.

Vessel numbers. Over 900 vessels are tracked with the system, which has a maximum capacity for 2,000 vessels in its present configuration. There are currently 921 'active' vessels of all types in good standing on the Regional VMS Register until the end of the registration year on 31 August 2004. Of these, 16% are FFA-flag, 76% are flagged in non-FFA signatories to the WCPFC Convention. The remaining 8% includes vessels registered in several flag of convenience countries. The vessels on the Register are flagged in 29 different states. The FFA Regional (vessel) Register is effectively identical to the FFA Regional VMS Register. A table showing numbers of vessels by flag state is provided in the Annex.

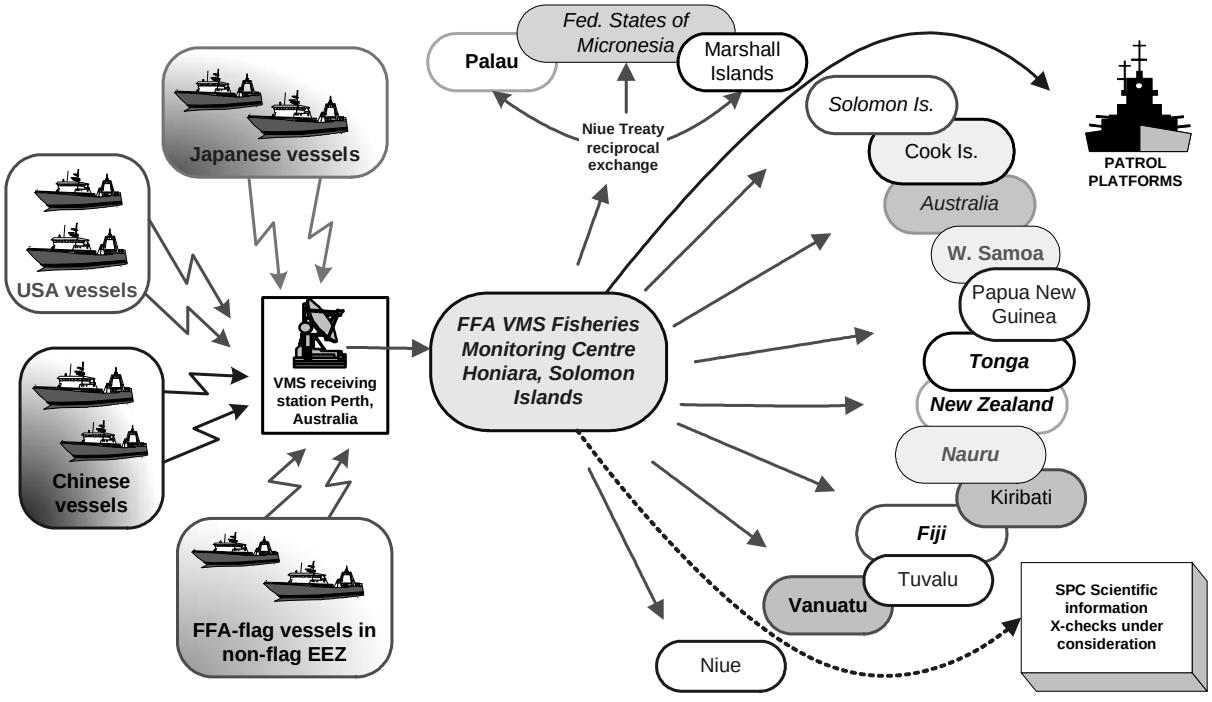

Figure 2. Diagrammatic representation of FFA VMS

VMS reports. The FFA VMS receives automatic position reports at a default rate of 6 reports per 24 hours. This frequency can be increased to 1 report every 15 minutes through polling. If a vessel's VMS unit (ALC) is switched on while it is on the high seas, the FFA will receive automatic position reports

from that vessel. The U.S. has agreed that U.S. purse seine vessels will provide automatic position reports to the FFA VMS at all times while these vessels are inside the Treaty Area, which includes high seas areas.

Details of the registration procedure are available in WCPFC/PrepCon/DP.23 and further instructions can be downloaded from the FFA website www.ffa.int.

3.6. OTHER REGIONAL FISHERIES ORGANISATIONS

3.6.1 International Commission for the Conservation of Atlantic Tunas (ICCAT)

In 2002, based partly on the results of pilot schemes, ICCAT adopted 'general principles of integrated monitoring measures', which include VMS measures. However, the Working Group on Compliance has made relatively slow progress in making this initiative operational. In its 2003 meeting, ICCAT recommended that all vessels over 24m in LOA report position at 6-hour intervals to their flag FMCs and encouraged the Parties to extend the use of VMS to smaller vessels as necessary. The flag state submits annual reports on the implementation of its pilot program for ICCAT´s annual report. Tuna/ HMS fishing vessels of Japan, China, Chinese Taipei, USA and Canada all use VMS in the ICCAT area.

ICCAT recommends that, as a minimum, the VMS system:

- is tamper proof;
- is fully automatic and operational at all times regardless of environmental conditions;
- provides real time data; and
- provides latitude and longitude, with a position accuracy of 500 m. or better, with the format to be determined by the flag state.

There are currently no provisions for transmitting VMS information to ICCAT. A centralised VMS is not envisaged in the near future. Procedures on the submission of aggregate information, how the information is shared between Contracting Parties, and appropriate measures to ensure confidentiality are among the issues to be resolved.

3.6.2 Indian Ocean Fisheries Commission (IOTC)

In 2002 the IOTC adopted a resolution regarding the establishment of a vessel monitoring system (Appendix B). A flag-state based two-year pilot programme is to be implemented by July 2003. The technical specifications of the programme are similar to those of ICCAT, including the provisions for transmission of position information in the event that the transceiver malfunctions. Flag states report annually to the IOTC on progress with VMS. Results will be evaluated by the Commission at its meeting in 2005, with a view to establishing a comprehensive VMS program.

3.6.3 Inter American Tropical Tuna Commission (IATTC)

IATTC management measures do not require use of VMS. Discussions concerning VMS are ongoing. IATTC considers that VMS would be of value both for fisheries and oceanographic research and for compliance, including assisting communications from observers (see Document IATTC-70-09 on www.iattc.org). Some IATTC members do not have a functioning VMS. A pilot scheme similar to those recommended in ICCAT and IOTC has been proposed.

3.6.4 Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

The Convention does not specify a geographical area of competence, but focuses on the conservation of the stock of southern bluefin tuna (SBT) in all oceans. Conservation measures are adopted by unanimous vote. CCSBT conservation measures do not require the use of VMS.

In 2002, 60 Chinese Taipei vessels harvested the SBT quota. Over 150 Chinese Taipei vessels were registered to catch SBT (targeted plus bycatch). Over 200 Japanese vessels fish for SBT. Between 50 and 60 of these vessels fish in the Pacific. Their respective fisheries adminiostrations oblige Chinese Taipei (since April 2002) and Japanese vessels to carry VMS. The Korean fleet operates predominantly in the Indian and Atlantic Oceans. Australian and NZ vessels carry observers.

3.6.5 Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)

The area under the competence of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) includes both high seas and a number of EEZs of island possessions of Australia, France, South Africa and the UK.

Under Conservation Measure 10-02 all parties have an obligation to ensure that vessels licensed for all fisheries, except krill, use tamperproof VMS. The VMS must provide 'real time' position information. The parties are obliged to transmit the VMS information to CCAMLR within 2 working days of receipt. Position information is required when vessels enter the Convention Area and when the vessels move between the various statistical areas. There are various provisions pertaining to the failure of VMS equipment. Implementation of the VMS measure is the sole responsibility of the member country.

The CCAMLR Secretariat does not pass VMS position information to member state patrol vessels in the CCAMLR area. VMS position information is not currently cross-checked with catch information. Non-VMS position reports may be used as an indicator of fishing effort in areas where special conservation measures apply. CCAMLR is initiating a study on a centralised VMS system using 'dual transmission' of VMS information from the vessel to both flag states and the Commission.

3.6.6 Sub-Regional Fisheries Commission (SRFC)

Approximately 70% of the industrial fleet operating in the SRFC area (Mauritania to Sierra Leone) is non-SRFC flag. To improve control over these fleets, which target both demersal species and HMS, a technical workshop of the SRFC has recommended that the introduction of VMS be considered as part of the regional strategy. In Senegal private companies track approximately 60 trawlers using VMS. Mauritania is in the initial phases of VMS introduction. A summary of the workshop recommendations is provided in the Annex.

3.6.7 Southwest Indian Ocean (SWIO)

A VMS cooperation workshop was held in 2003 and attended by technical representatives of the following coastal states: Comoros, France (Reunion), Kenya, Madagascar, Mauritius, Mozambique, South Africa, Seychelles, Tanzania, and UK (BIOT). There was unanimity on the necessity of enhanced cooperation between SWIO countries on MCS in general and on VMS in particular. The workshop recommended:

a) establishment of a database of all vessels;
b) establishment of automatic forwarding by VMS information between coastal states. The information should include position and catch upon leaving EEZs with particular reference to EEZ entry and exit information; and
c) establishment of requirements for vessels to report position and catch from high seas areas, either to the coastal states or to IOTC, or other appropriate RFO.

4. INSTITUTIONAL OPTIONS FOR THE WCPFC

Under Article 24 of the Convention a number of key requirements for the VMS system are set out.

4.1. DEFINING THE TARGET FLEET

All fishing vessels as defined in Article 1(e) of the Convention are obliged to use VMS for position reporting. This definition includes all carrier and support vessels. Under the specifications for the VMS system to be established under Article 24.8 vessels which fish exclusively within their flag state EEZ are exempt from this requirement.

Article 24.8 states that the VMS requirement applies to 'fishing vessels that fish for highly migratory species'. This is interpreted as meaning fishing vessels that target HMS, and excludes vessels that catch HMS as bycatch of fishing operations directed at other species. Some vessels may target HMS on a seasonal basis, such that the proportion of HMS in the vessel's annual catch is less than 50%. While it is unlikely that significant numbers of such vessels exist, or that they have significant HMS catches, a provisional quantitative rule may be of use, e.g. VMS is required if 25% of the vessel's annual catch consists of HMS.

The VMS system must take the characteristics of traditional vessels into account. Some traditional vessels may fish for HMS outside their flag state EEZ, e.g. in the Sulu Sea, or Torres Straits. The numbers of traditional vessels fishing for HMS on the high seas in the Convention area is probably negligible. A working hypothesis is that traditional vessels are of timber construction and are less than 24m in length overall. Vessels meeting these characteristics could be exempted from the VMS requirement. Under EC legislation vessels operating exclusively within 12 nautical miles of the baseline of the flag Member State, or which never spend more than 24 hours at sea taken from the time of departure to the return to port, are exempt from the VMS requirement.

Exemptions from the VMS requirements specified in Article 24 could be of a temporary nature, or derogation. Any exemption would automatically expire after a certain period, i.e. the exemption would have to be periodically reviewed and re-adopted by the Commission.

There are numerous advantages in obliging carrier/ support vessels to report position with VMS. These include the possibility of cross-checking catches and/ or landings; tracing oil spillages from refuelling operations, and tracking the flows of economic benefits from the fisheries. To ensure that carrier and support vessels flagged in non-WCPFC countries comply with the VMS requirements, WCPFC vessels could be prohibited from transhipping to/from such vessels unless they comply with the VMS requirements of the Convention. Similarly, carrier and support vessels flagged in WCPFC member states may be prohibited from transhipping to/ from vessels that do not comply with the provisions of the Convention.

It has been estimated by the SPC that there may be up to 2,000 vessels that fish for tuna in the Convention Area, in addition to those in good standing on the FFA Regional Register (921 vessels). Thus a WCPFC VMS will have to accommodate in the order of 3,000 vessels. A cleared definition of the vessels required to use VMS will assist members to establish a more accurate figure.

If a phased development of the VMS is required, the vessels referred to in the Conference literature as large-scale tuna fishing vessels (LSTFVs, or vessels in excess of 24m length overall) would form a suitable group for initial application of the VMS requirement. If the development of an indicator of fishing effort derived from VMS information is considered a priority, then the purse seine fleet are probably a priority set of vessels for early application of the VMS requirement.

Conclusions. An expanded working definition of 'vessels that fish for HMS' and 'traditional vessels' is required. Provisions may be required in relation to carrier and support vessels flagged in non-member countries. If a phased introduction of the VMS is required the priority groups of vessels include the purse seine fleet and those referred to as 'large scale tuna fishing vessels'. The cooperation

of all interested parties is required to accurately estimate of the number of vessels to be included in the VMS.

4.2. AREAS AND JURISDICTIONS

Areas. There are three different areas of 'VMS jurisdiction' within the Convention area:

- EEZs of flag states, where the flag state's VMS is required;
- EEZs of coastal states where the coastal state's standards and requirements for VMS must be respected; and
- the high seas where the Commission's VMS standards and requirements must be applied (Article 24.8).

Harmonised VMS requirements will benefit all parties: flag and coastal state fisheries administrations charged with operating the VMS; vessel operators who may fish in several different EEZs; and the Commission in its task of integrating and analysing the patterns of fishing.

NEAFC model. As the Commission's VMS requirement under Articles 24.8 applies only to the high seas areas, many of the procedures of NEAFC are directly applicable. NEAFC receives position information through the flag state FMC when the vessel is in the NEAFC high seas area. However, NEAFC receives position and catch information from the vessel prior to the vessel's entry into the NEAFC high seas area.

FFA model. Under Article 24.8 any Commission member may request that the waters under its national jurisdiction be included in the Commission's VMS. This arrangement could be similar to the VMS service provided by the FFA to its members.

National maritime boundaries. Ideally, for the purpose of effective VMS, countries should clearly define their maritime boundaries and conclude boundary agreements where necessary. Lack of clarity may destroy any civil or criminal cases and may cause dissent between members. By 'grey zones' is meant marine areas claimed by two, or more countries. In the event that 'grey zones' exist in the Convention area, joint VMS coverage of the grey zones can be considered, i.e. vessels in the grey zone report to both countries and to the Commission as required. Several precedents exist including: the 'dogleg' between France, UK and Ireland and the Barents Sea 'loophole' between Norway and Russia.

Charting. Ideally, the VMS requires a common chart of the high seas areas so that the agreed coordinates of the high seas areas can be programmed into the VMS software, either in the on-board VMS units, or at the FMCs of the members and cooperating parties. This is a technical exercise requiring further advice and eventual agreement between the members. The common chart can be extended to include the coordinates of boundaries between contiguous EEZs and the coordinates of areas where fishing may be restricted. The digital charting of FFA member EEZs has been a practical necessity for operation of the FFA VMS.

Fishing vessels may also have difficulty in knowing the precise location of EEZ boundaries and other regulatory areas, as this information may exists only in national legislation and is not printed on marine charts. There is thus a clear need for national VMS monitoring centres to maintain charts of foreign regulatory areas, in addition their own, and, if possible, to alert vessels from their fleet when they enter these areas. An agreed and harmonised digital chart(s) of the Convention area showing agreed maritime boundaries and high seas areas would assist establishment of the VMS.

Conclusions. For both scientific and compliance purposes, the Commission should ideally have a complete VMS position record of a vessel's trip. If this is not possible, then a complete trip record, excluding the time spent within the flag state EEZ is desirable. If members are unwilling to release 'raw' VMS position information to the Commission with respect to vessels within their EEZ, then some form of aggregate information could be provided. Alternatively the VMS position information

for foreign flag vessels could be provided to the Commission. Provision of VMS information additional to that required under Article 24.8 is closely linked to assurances of confidentiality and clear knowledge of the uses of this information.

4.3. TYPES OF VMS INFORMATION

4.3.1 Basic position information

Article 24.8 refers only to vessel position information. This is the most basic requirement of a VMS and gives vessel latitude, longitude plus a date/ time stamp. Analysis of this vessel position information provides a quasi real time indication of the activity of the fishing vessel, e.g.:

- derived speed and course;
- estimate of fishing effort measured in days at sea;
- determination of likely port of landing;
- determination of transit or fishing activity in restricted areas;
- determination of probable fishing activity using speed;
- determination of fishing activity using a "fishing fingerprint"; and
- prediction of future activity of vessel.

Fishing fingerprint. The fishing fingerprint, or digital signature of the vessel can indicate if the vessel is transiting, fishing, of searching. The accuracy of the inference depends largely on the frequency of the VMS reporting. The FFA VMS will automatically generate an alert message if purse seiner's speed drops below its rated speed. This may in turn prompt the national FFA VMS operator to increase the reporting rate for that vessel. Neither FFA nor NEAFC currently use the 'fingerprint' to determine fishing effort although the scientific bodies in these regions have expressed interest in the use of VMS information to determine, or crosscheck effort.

Position transmission data protocol. Harmonisation of the data formats for transmission of VMS information between FMCs, and between FMCs and the Commission is fundamental. There are no global standards, but there are at least two widely used international formats: the North Atlantic Format used in FAO areas 21 and 27, and the FFA format (the differences, if any, will require further study). The NAF includes a specification for the transmission of catch data (see Annex). Once a format is decided, any changes involve major problems and expense, as part of the software supporting the VMS and related communications may have to be rewritten. FAO has recognised this difficulty and a technical consultation on VMS data formats will be held in 2004 to make the initial steps towards a standardised global VMS data exchange formats.

Data standards. Advice on data standards has been provided in WCPFC/PrepCon/WP.15. Additional detailed advice on specific VMS data standards may be required.

4.3.2 Possible future VMS information requirements

Several other types of information can be captured and transmitted via VMS communications. Scientific uses include the tracking of tagged fish, marine mammals, or turtles and the reporting of sea temperatures. Catch information can provide the markets with guidance on supplies. Price information can persuade fishers switch target species. It is possible to monitor bycatch and discards using video links.

The Technical and Compliance Committee of the Commission is to 'review the implementation of cooperative measures for monitoring, control, surveillance and enforcement adopted by the Commission and make such recommendations to the Commission as may be necessary' (Article 11.1) …. developing and reviewing measures to provide for the verification and validation of fisheries data…'. Of particular interest are the possibilities for catch reports, electronic logbooks and management of effort using the VMS.

Catch reports. Reference has already been made to the use of catch reports in the NEAFC and CCAMLR areas. The catch reports are made prior to entry to or exit from the management area, or when a vessel moves from one statistical area to another. Such catch reports would have value in the Convention area for verification and cross-checking of logbook data, to provide a timely overview of the status and trends in the fisheries and fishing areas, and as a basis for onboard inspection from patrol vessels.

Electronic logs. The scale, geographical extent and complexity of the fisheries warrant serious consideration of the use of harmonised electronic logbooks (e-logs). Such logbooks schemes are in various stages of implementation in many countries. The initial problems regarding their design and adoption by fishers are gradually being resolved. The e-logs provide many advantages (see Annex for further details). In particular the e-log provides an internationally transparent historical record of fishing activity by the flag state's vessels, sometimes referred to as the 'track record'. Such a transparent record may be of value in future negotiations for quotas, or fishing rights (see Article 10.3. (c)). The e-logs will also greatly assist in the capture and timely analysis of catch and effort data and enable real time verification of landings and transhipments.

Effort control. Under the Palau Arrangement there is an upper limit of 205 purse seiners allowed to fish in the area under the jurisdiction of the parties to the Nauru Agreement. However, there is currently no limit on the total tonnage, or fishing capacity[2] of the purse seine fleet. The parties agreed that a long-term management system based on national limits on the number of purse seine days should be further developed. The VMS is likely to be a primary tool for implementing such a scheme.

Fish aggregating devices (FADs). FADs equipped with GPS and VMS are of growing importance in tuna fisheries. The FADs may concentrate juvenile fish and greatly enhance the level of real fishing effort. Enhanced regulation and control over FADs may require consensus among Commission members on the property rights over drifting and high seas FADs. It is also conceivable that future effort regulations may require that FADs be registered and fitted with some form of VMS.

4.3.3 Polling and compliance communication

The FFA considers polling an essential feature of the VMS. NEAFC's 'stop fishing' and 'remain in the regulatory area' messages are further examples of the utility of the polling and communication features.

4.3.4 Conclusions

A vision of the future role, structure and operation of the VMS system is required. The Convention makes little specific reference to the use of the VMS information. The VMS position reporting can be seen as but one dimension of a comprehensive fisheries communication and information system for the Commission. This electronic communication system can be the 'information highway' for the Commission, capturing catch and effort information in near real time as a data feed for management models. A phased and prioritised development of a comprehensive information system, of which the VMS is but one component, is likely to be a cost-effective medium to long-term approach.

If, in accordance with the precautionary approach (Article 5(c)), decision rules are predetermined by the Commission, such an information system can provide a rapid response capability for management. Communication of 'catch on board' information on entry to/ exit from EEZs is highly desirable. VMS provides the optimum means of communicating this catch information.

[2] Reid, C. et al. 2003. An analysis of fishing capacity in the western and central Pacifc Ocean tuna fishery and management implications. Marine Policy 27 (2003) 449–469.

An enhanced communication system may also improve economic returns to the fishery by providing markets with supply information, giving vessels access to electronic sales, and helping to stabilise price fluctuations.

Polling is seen as a highly desirable feature for the VMS system. In the absence of a polling feature, 'smart' pre-programmed VMS units that record and then download multiple positions may be an alternative. However there are practical difficulties in altering numerous pre-programmed VMS units if zoning, or other regulations change.

4.4. SYSTEM ARCHITECTURE

As the WCPFC VMS must cater for both high seas and waters under national jurisdiction it must draw upon the VMS architecture of several different fisheries organisations and arrangements.

NEAFC provides a model for the high seas VMS. FFA provides a model for VMS in waters under national jurisdiction. The EU and arrangements between Palau, Marshall Islands and Federated States of Micronesia pursuant to the Niue Treaty[3] provides a model for reciprocal exchange and sharing of VMS information.

4.4.1 Possible VMS data transmission paths

Transmission from vessel to Commission. Because of the variety of institutional arrangements of the parties to the Convention the VMS may have to accommodate several different transmission pathways at least during the initial phases of the VMS.

Direct, near real-time and simultaneous transmission. 'Near real-time' is essentially a function of VMS satellite used and the area of operation of the vessel and could be measured in minutes, or hours (see 'Technical issues'). 'Simultaneous transmission' is taken as meaning that the VMS position information is automatically re-transmitted by the flag state FMC to the Commission. The delays involved are solely a function of the equipment and the software, which must meet certain minimum requirements. Automatic re-transmission from a flag state FMC to the Commission is interpreted as complying with the term 'directly' in Article 24.8, subject to compliance with transmission standards and protocols agreed by the Commission.

From vessels on the high seas.

A. High seas vessel ***TO*** flag state FMC with automatic, simultaneous re-transmission ***TO*** Commission.
B. High seas vessel ***via*** direct transmission ***TO*** Commission.

From FFA member state-flag vessels on the high seas.

C. From 'FFA-flag vessel' on the high seas ***TO*** FFA with automatic, simultaneous re-transmission ***TO*** Commission, subject to the FFA being an 'organisation designated by the Commission' under Article 24.8.

From vessels within EEZs subject to approval of a request by a member under Article 24.8.

D. Vessel in flag state EEZ ***TO*** flag state FMC with automatic, simultaneous re-transmission ***TO*** Commission, or ***via*** direct transmission ***TO*** Commission.

[3] ARTICLE V - EXCHANGE OF INFORMATION

1. Each Party shall, to the extent permitted by its national laws and regulations, provide to the South Pacific Forum Fisheries Agency, or to any other Party directly, information relevant to the purposes of this Treaty, including but not limited to information about: (a) the location and movement of foreign fishing vessels; …

F. Foreign vessel in an EEZ ***TO*** EEZ state FMC with automatic, simultaneous re-transmission ***TO*** Commission, or ***via*** direct transmission ***TO*** Commission.

G. From 'FFA-flag vessel' in an EEZ ***TO*** FFA with automatic, simultaneous re-transmission ***TO*** Commission, subject to the FFA being an 'organisation designated by the Commission' under Article 24.8.

All transmissions are via land stations. The transmission pathways for FMCs linked to, fishing entities are considered to be similar to those for the FMCs of flag states.

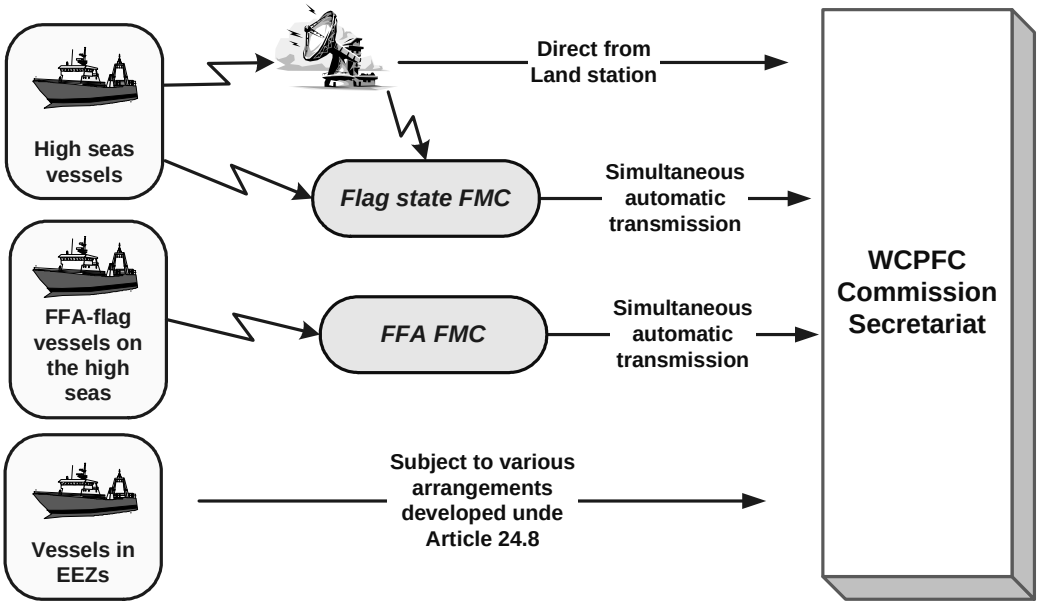

Figure 3. Diagrammatic representation of VMS transmission paths

4.4.2 Polling

The general requirement for polling must first be agreed by the Commission. The introduction of polling could be phased to allow vessels and FMCs that do not have a polling capability to adapt equipment, software and procedures. Polling is likely to be required in several situations:

- when fishing is taking place on the high seas in close proximity to an EEZ boundary;
- when fishing is taking place in close proximity to restricted areas, such as those reserved for small-scale fishers;
- if the Commission designates certain areas for limited effort or other fishing restrictions;
- during surveillance exercises; and
- upon the detection of VMS anomalies, e.g. suspected unreported transhipment.

Three polling pathways can be envisaged:

- initiated directly by the EEZ FMC with a 'copy' to the Commission;
- initiated by the Commission based on agreed procedures; or
- initiated by a request to the flag state FMC via the Commission.

4.4.3 Transmission from the Commission to other parties.

'Raw' near real-time VMS information is unlikely to be regularly transmitted from the Commission either to members, or other parties. Subject to agreement, information on tuna vessels transiting to the Indian Ocean could possibly be transmitted to the IOTC, or CCSBT. However, neither commission currently has a VMS. Subject to special procedures information on vessels suspected of illegal activity

could be sent to a non-member flag state, or a port state requested to detain the vessel. Procedures are likely to evolve in response to member's specific requests and incidents and need not be the subject of immediate attention.

Aggregate VMS information analysed to show recent trends in the fisheries may be needed by all members. Initially summary information can be distributed in a timely manner. The level of detail can be gradually enhanced in accordance with rules approved by the Commission.

Transmission of aggregate information to national, or regional scientific bodies for scientific purposes will require further detailed study. Discussions between ICES and EU and between FFA and SPC may provide guidance.

4.4.4 VMS conceptual modules

The following text and graphics are provided purely as an exercise in visualising the evolving shape of one possible structure for the Commission's VMS. The VMS is presented as a set of modules. Each may refer to a different set of vessels, or a different maritime area, and each may have differing rules of procedure.

The NEAFC, or high seas module. This is the 'core' module for the Commission with respect to the high seas. The vessels directly transmit VMS position messages to the Commission, or the FMCs of members automatically and simultaneously re-transmit VMS position messages to the Commission with respect to their vessels fishing on the high seas. The Commission's FMC, through its software harmonises any differences in VMS data transmission until all members have adopted common formats and protocols.

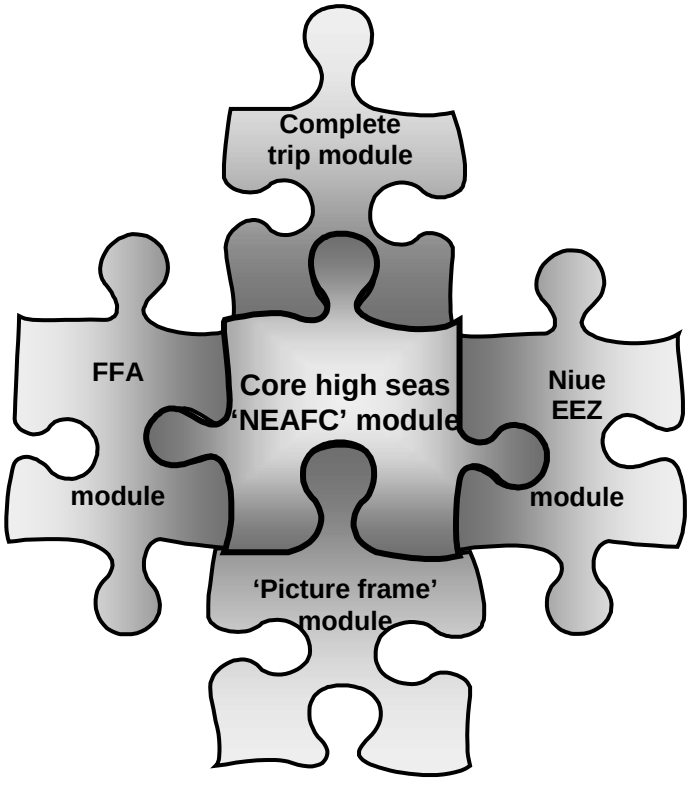

Figure 4. Conceptual diagram of possible VMS modules

The FFA module. The FFA, on instruction from the FFA members, automatically re-transmits to the Commission VMS position information with respect to FFA-flag vessels operating on the high seas. A

VMS agreement is concluded between the FFA and the Commission. Transmission of VMS information from FFA to the Commission with respect to foreign-flag vessels operating in EEZs would be subject to further study and agreements.

The EU/ Niue module. A framework agreement is concluded under which members may exchange VMS data directly and automatically between FMCs with respect either their own flag vessels, or to foreign vessels.

The 'picture frame' or MLT module. A fishing entity, or country agrees to provide all VMS position data to the Commission, irrespective of whether the vessels is operating on the high seas, or in an EEZ. The area could be the entire Convention area, or an area defined in a treaty such as the US MLT.

The complete trip module. The complete trip VMS record is made available to the Commission. This information could be provided retrospectively rather than in real time. It may be of particular value for monitoring compliance by reefer and support vessels. Explanation of 'missing' segments of a trip will also be of compliance interest. The complete trip record could include segments outside the Convention Area.

4.5. CONFIDENTIALITY

4.5.1 A divided responsibility

'Raw' VMS information is legitimately confidential commercial information. Even aggregate VMS information may reveal valuable commercial insights and must be regarded as confidential unless it is released under approved guidelines and formats. Historical information can be equally valuable. This confidentiality is an extremely sensitive issue for the fishing industry. Vessel operators must have assurance that information will remain confidential, and that legitimate stakeholders have equal access to any summary information that may be divulged.

The responsibility for confidentiality is distributed among the various links in the information chain:

- the manufacturers of the VMS units to ensure that the units meet certain standards;
- the satellite service providers, land station operators and communications companies to ensure that there is no 'leakage' of VMS information in transit;
- the national fisheries administration when the VMS information is received by the FMC;
- the Commission when the VMS information is received; and
- any intermediaries, or service companies which may be contracted by any of the above.

4.5.2 Safeguarding confidentiality

Confidentiality must be safeguarded through legal, physical and procedural means. The physical and procedural means are broadly similar at national level and for the Commission. However, the legal provisions for data protection for the Commission will be based on the legislation in the country where the Commission's VMS data handling is located.

Legal safeguards. Provisions relating to the keeping, access to, use and disclosure of confidential information can be found in different pieces of national legislation. 'Trade secrets' acts protect of commercially sensitive information, limiting disclosure of information that may lead to a commercial disadvantage. Rights to privacy acts often do not permit direct or indirect identification of natural or legal persons. In some countries rules on confidentiality and disclosure exist in fisheries legislation. There is a growing body of legislation prohibiting 'hacking' and computer fraud.

The contracts under which data and other services are provided, including those with the satellite service providers, communications companies and computer maintenance companies, should make adequate provisions for confidentiality.

Physical safeguards. Access to premises where VMS information is stored and to the information itself must be restricted. For this reason FMCs are often located on a naval, or coastguard premises. Persons given access should be held accountable for unauthorized disclosure. Such persons must be informed of these responsibilities and may be required to sign a statement of confidentiality.

Procedural safeguards. Data security must conform to a specific standard. NEAFC specifies conformity with Section 2.2 of the U.S. Department of Defence Trusted Computer System Evaluation Criteria (TCSEC), DOD 5200.28-STD. A copy of the NEAFC data security requirements is provided in the Annex. NAFO confidentiality and data security provisions are available on: www.nafo.int NAFO/FC Doc. 04/1, Annex XX, Serial No. N4936.

Authorised access. National authorities and the Commission will require to specify what constitutes authorised use of different forms of VMS information (e.g. 'raw' and aggregate). The conditions for access to VMS information for research purposes, retransmission to patrol vessels, or emergency search and rescue will need to be determined. A VMS record may be required in relation to catch documentation. In such cases the Commission may only require to assert that the VMS track does not show evidence of illegal fishing activity. Release of information for evidentiary purposes may be subject to the laws of the Commission's host country and agreements on 'long-arm jurisdiction' between countries. Possible disputes between members may be avoided, if the Commission agrees the basic principles, under which the Commission can release VMS information for evidence.

4.6. RESPONSIBILITY FOR VMS

Under Article 15 the Secretariat has the role of 'facilitating the compilation and dissemination of data necessary to accomplish the objective of this Convention; [and]…administering agreed arrangements for monitoring, control and surveillance' in a cost-effective manner. This gives the Secretariat has the mandate to administer the VMS system. The Technical and Compliance Committee has an important role in reviewing and recommending upon VMS matters (Article 14.1 (c)).

Under Article 24 the flag states and cooperating fishing entities have responsibility to ensure that its vessels are equipped with a functioning VMS, which meets the Commission's specifications.

Under Article 22 the Commission has responsibility to cooperate with regional fisheries organisations such as the FFA on matters related to VMS.

4.7. COSTS AND BENEFITS

Estimation of the costs and benefits of a VMS require further detailed study. Valuation of the benefits presents difficulties as the VMS is seen as but one tool in a suite of fishery management and protection measures. It is complementary and supportive to other control and enforcement initiatives, without which neither the VMS, nor the other MCS measures may be effective. As the Commission is already committed to acquiring a VMS the focus of attention may be directed towards:

- Specifying the technical requirements of the system with a view to its expanded use, possibly as the principal fisheries information conduit in the medium/ long-term;
- Maximising the effectiveness of the system and reducing its capital and recurrent costs, possibly through Commission-wide contracts for services.
- Sharing information and technical advice among the Contracting Parties to promote equivalence and data exchange as may be required among the VMS of the Parties.

Indicative costs of on-board VMS units are between US$ 2,500 and US$ 4,000 per unit. The cost of a monitoring centre ranges from US$ 5,000 in the case of a company fleet (PC and software) to several million US$ in the case of a major national, or regional VMS which may have secure, climate controlled buildings and several backup systems.

The annual cost of monitoring the EU fleet of 4,000 vessels is estimated to be in the order of Euro 8 Million. An estimated increase of 20% in the effectiveness of marine surveillance, which has an estimated annual cost of EURO 100 Million, is considered to justify the cost of the VMS. The UK has recently contracted for a new VMS at a value in the order of US$ 1.5 million. The FFA charges an annual registration fee of US$ 845, which provides an indication of the annual operating cost of the system (approximate annual revenue of US$ 0.8 million).

4.8. TECHNICAL ISSUES

At a minimum, technical decisions must be made regarding the satellite system to be used, the VMS unit type and its physical and functional requirements, the nature of the FMC and the scope of the program (i.e. type of vessels included and data to be transmitted).

4.8.1 Satellite suppliers

There are currently two suppliers of suitable satellite services suitable for vessel monitoring throughout the Convention area: Argos and Inmarsat C. Discussion of the satellite services is restricted to these two for the following reasons:

- They provide coverage for the entire Convention area.
- Both provide tried and tested VMS and meet the VMS requirements of many countries.
- They have adequate support services and agencies throughout the Convention area.
- The companies owning and operating these services appear to be financially and institutionally sound so that there is a high probability that these services will continue for the foreseeable future.

ARGOS	Inmarsat-C
Advantages	
World-wide coverage Simple and reliable Relatively low power consumption Integrated (turnkey) delivery of VMS and associated software, support and training	Quasi real-time data Small and light equipment Multiple manufacturers and softwares GMDSS (safety at sea) Data messaging Two-way communication (polling)
Disadvantages	
Delays in delivery of data One-way communications only – no polling (this is reported to be about to change)	Equipment relatively expensive No coverage in polar regions Requires sturdy power supply

Argos. Argos satellites have a circumpolar orbit and provide full global coverage. However, the reception of vessel position data by the satellite may have to await the passage of the satellite over the ocean area where the vessel is located. A further delay may occur while the satellite moves within range of the nearest land receiving station to which it can download the vessel's position data. Delays of several hours may occur in equatorial regions. Estimated reception /transmission delays are more than 70% in less than 20 minutes. Argos is currently a one-way communication system does not currently support polling, e.g. the national fisheries authority is unable to instruct the VMS unit on board the vessel to transmit its position more frequently. The Adeos II satellite with a two-way Argos payload on-board is now out of order and the next satellite with such a payload is METOP, planned to be launched in 2005.

Argos offers an integrated VMS package (see www.cls.fr). It will supply: the VMS units; the computer and other equipment needed for the FMC; and the software, including the electronic maps, required to operate the VMS; the training of FMC staff; and the maintenance and other services. The approximate numbers of Argos VMS units in vessels flagged in Convention signatory countries is as follows:

USA (Alaska) / Canada	650	Indonesia	1,500
China	30	Micronesia	5
Korea	380	New Zealand	50
Japan	750	Tonga	50
Chinese Taipei	230	**Total**	**3,645**

Note: Not all these vessels are tuna vessels, nor do they necessarily fish in the Convention area.

Inmarsat C. Inmarsat C satellites are geostationary and positioned over the equator. They do not give coverage of the polar regions. However, this is of little consequence to the Commission. Inmarsat guarantees 99.9% coverage of the area between 76^{o}N and 76^{o}S, as required by the GMDSS (maritime distress calls) system supported by Inmarsat. Inmarsat C is a two-way communication system. The vessel owner, or FMC can remotely alter the parameters of the Inmarsat C terminal on board the fishing vessel. For example, by 'polling' the vessel the frequency of transmission of position reports can be altered. There are over 60,000 Inmarsat C terminals installed worldwide on fishing, commercial and recreational vessels. The Inmarsat commercial organisation only supplies the satellite services. The VMS equipment and some services (on-board units, FMC computers, software, operation of land receiving stations, training) are supplied by private companies, which have commercial relationships with Inmarsat. Further details are available at: www.inmarsat.org.

In addition to data transmission, both Inmarsat C and Argos support a range of other communication devices including emergency signalling, email, and telephone. 'Smart' VMS units exist for both Argos and Inmarsat C. These units can be programmed to send position information more frequently if the vessel is close to a prohibited, or closed area.

Costs. Possible cost differences require additional study in relation to a particular VMS configuration. The capital and recurrent costs such as transmission costs are variable. The costs are particular to the scale and specifications of the VMS and subject to negotiations with suppliers. In the case of Argos, services are priced on a flat rate basis defined in relation to a number of parameters such as: the number of vessels to be contracted, the duration of the contract, the number of position to be distributed. Argos service price is fixed, whatever the number of address where to deliver the data.

Key differences. For the purposes of fisheries control, the key differences between the two systems are:

- Polling. Argos currently does not support polling.
- Near-real time. Inmarsat C signals are likely to be received more rapidly by FMCs. There can be substantial delays with Argos in tropical latitudes.
- Installation and maintenance. Argos offers integrated solutions from a single supplier. Inmarsat C involves a minimum of two suppliers.

It is apparent that, within the Convention area, Inmarsat C currently has technical advantages over Argos in terms of polling capability and timeliness of position reporting.

GPS satellites. The VMS takes its position information from a US-operated set of GPS satellites. Another Galileo position fixing satellite system is planned to come into operation later in the decade.

4.8.2 Harmonised technical standards

Technical standards are beyond the scope of this discussion paper. Harmonised technical standards may be required as regards:

- the technical specifications of the VMS units;
- the exchange of position data (with the time and date stamp) between recipients, e.g. FMCs;
- polling protocols (if considered to be a necessary feature of the VMS); and
- catch reporting by satellite communication, initially as a 'total catch on board' on entry to/ exit from EEZs, and later as a full electronic logbook, eventually substituting the paper logbooks.

FFA format. The FFA already has established standards (type approval)for VMS units.

North Atlantic Format. This is a standardised VMS data transmission format used between NEAFC and NEAFC members, in the EU, in NAFO, and in several bilateral fisheries agreements, such as those between Norway and Russia.

Authorised data exchange protocols for electronic transmission of reports and messages between contracting parties and the regional fisheries organization are usually X.25 and X.400. Internet-based protocols (e.g. HTTP protocol) also offer secure alternatives to X.25 and X.400. Other protocols are also available, but have not yet been tested.

Agreed international data exchange standards. During 2004 the FAO plans to convene a technical meeting to recommend upon VMS data exchange standards.

4.8.3 Tampering with the VMS

Reliability. Strict adherence to adequate technical specifications of the VMS units is important. Up to 5% of VMS units in some EU fisheries may be non-functional at any given time. Malfunctioning VMS units undermine the integrity and transparency of the system, which must be seen to be a 'level playing field' for all vessels.

Falsifying the VMS signal. Recent studies commissioned by the EC indicate than many of the VMS units currently manufactured have a low level of security from tampering. Of particular concern has been the use of a false computer generated GPS signal. Solutions include: improved technical specifications; cooperation among manufacturers to agree on tamper proofing standards; and software checks to identify signal anomalies.

Tamper proofing. A number of measures can deter tampering:

- integration of the VMS and GPS electronics and antennas in a single case protected by a tamper evident deco or seals;
- light sensors to detect that VMS unit compartments have been opened causing an 'intrusion alert' message to be immediately transmitted to the VMS satellite;
- tamper-resistant screws closing the access to the VMS compartments;
- tamper-evident seals or decos on screws, cable outlets, wiring, ports and junction boxes;
- use of plastic mouldings, soldered, or integrated components; and
- random, or requested cross-checking of signal origin using Doppler.

In order to prevent tampering, there have been moves to reduce the communications capabilities of the VMS units. However, this may be counterproductive to the development of electronic logbooks, facilitating crew email and other evolving communications.

4.9. LEGAL ISSUES

4.9.1 Legislating for VMS

Effective national VMS legislation is necessary to implement the VMS requirements of the Convention. International legal instruments are normally made binding on persons, or vessels operators through national legislation. A range of other legal issues related to VMS, including confidentiality, evidence, and maritime boundaries also require appropriate national laws. Expert legal advice is likely to be required on the legal dimensions of VMS legislation. In this regard, the following points and issues are of note:

- The relevant parts of the fisheries and VMS legislation must apply outside jurisdictional waters to ensure that the flag state can enforce the Convention's VMS requirements on the high seas and in the waters of third countries. Powers of inspection and control on high seas may need to be specified.
- The nature of electronic data, its status as evidence and custody of the chain of electronic evidence must be considered if VMS is to be used in prosecutions.
- Authorisation for a national fisheries administration to share 'private' commercial VMS information with the Commission may require legislative change, although this may be circumvented by requiring the vessel operator to authorise this data sharing in a fishing licence application.
- As the VMS tracks not only the vessel, but also the crew, it may constitute an invasion of privacy.
- The VMS units must be irrefutably linked to a vessel; otherwise the system is tracking VMS units, not fishing vessels. This underscores the importance of the legal aspects of the VMS unit installation and the links between vessel and VMS registers.
- Civil and criminal offences. In 'common law' countries an offence against the fisheries laws may be a criminal offence. Criminal offences require a higher standard of proof than civil offences. Criminal prosecutions require proof beyond reasonable doubt, while in civil proceedings the preponderance of the evidence may be proof of an offence. In common law countries, VMS information may be inadmissible in criminal proceedings due to the rule against hearsay evidence. The hearsay rule may be overcome by exceptions such as 'rebuttable presumption' and 'judicial notice'.

There may be advantages in harmonising certain provisions of the VMS legislation among the members. There are strong arguments in favour of some degree of harmonisation of sanctions for VMS violations. This may prove difficult in terms of criminal versus civil laws, administrative versus court procedures.

During the development of the FFA VMS, the FFA Secretariat provided draft model VMS legislation to each FFA member. Upon request, FFA may make this model available to the Commission. Such a draft may provide guidance on possible harmonization, or establishment of equivalence of some legislative provisions for VMS among members.

4.9.2 Nature of the VMS offence

Article 25.7 makes reference to sanctions for violations. The sanctions must be: effective in securing compliance; discourage violations; and deprive offenders of the benefits of their illegal activities. Equivalence among the members with regard to the nature of the sanctions is highly desirable. At least two types of VMS violations can be identified.

Failure to install and/ or operate the VMS. As a minimum, the flag state can withdraw the fishing authorisation of the vessel until the VMS is operational. In the event that the vessel is suspected of repeatedly tampering with the VMS, the 'three strikes rule' can be applied, i.e. on the third occurrence

the fishing authorisation of the vessel is automatically suspended for a period sufficient to deter further incidents.

Fishing in a prohibited area. VMS is particularly useful in detecting possible fishing in a prohibited area. The prohibited area could be an EEZ for which the vessel does not possess a fishing authorisation, a high seas sanctuary for protected species, or zones reserved for small-scale fishers. There are two basic options with respect to the prohibited area offence: (a) it is an offence to fish in the prohibited area; (b) it is an offence to be in the prohibited area. It may be difficult to prove that fishing was carried out on the basis of VMS evidence. If by its presence in the prohibited area the vessel is assumed to be fishing, then the onus is on the vessel to prove that it was not fishing. This latter approach may conflict with principles of freedom of navigation. Reversing the burden of proof[4] may not be possible in criminal law. Transit corridors, inspection checkpoints and obligations to hail of entry and exit have also been used with some success to address this problem.

4.9.3 Vessels in transit

Fishing vessels in transit pose a particular difficulty in the Convention Area. Under international law it may be difficult to impose an obligation to report position by VMS, yet compliance with the requirements for innocent passage (e.g. stowage of gear) are difficult to monitor. Malaysia physically inspects vessels in transit and South Africa encourages transiting vessels to hail entry and exit. This hailing of entry and exit is gradually becoming an accepted practice and features in many bilateral and multilateral fisheries arrangements.

In order to prevent disputes over inspections and unnecessary detentions of transiting vessels, and out of courtesy to other Commission members, hailing of entry and exit, preferably by automatic VMS message, could be considered as a general requirement. If necessary this could be complemented by a 'catch on board' message.

5. CONCLUSIONS

Vision. The Commission requires a long-term vision of the future scope and role of the VMS. It is suggested that the VMS can constitute the backbone of the Commission's information communication system, and that in the VMS should not be restricted to vessel position information. The design of the system should allow for the introduction of catch reporting and electronic logbooks in the medium to long-term.

Best practice. The Commission can draw on the experiences and lessons of other multilateral VMS users to identify technical and administrative options and best practices. The arrangements in the FFA, in the EU and in NEAFC are of particular interest and are likely to contribute features and solutions to the Commission's VMS.

Detailed analysis of issues. A broad range of issues will require discussion and preparation of more detailed options papers based on thorough study of the national VMS plans, the fisheries, fleets, fishing areas, technical and legal questions.

Fleets. The precise definition of the target fleets will require further consideration, with particular reference to bycatch of tuna, traditional vessels and non-member support vessels. The VMS can focus initially on priority fleets and fisheries and gradually expand its scope to embrace other groups of vessels.

Areas. The initial geographical target of the VMS is the high seas. However, subject to agreement by the members, the VMS could plan for the capture of the VMS position information for the complete

[4] The Queensland fisheries legislation requires the person to prove that the vessel was not where the VMS indicates in order to prove innocence.

trip of a vessel, or groups of vessels of special interest. Harmonised electronic charts of the Convention area are desirable. Administrative 'fixes' may be required if maritime boundaries are subject to dispute. Details of a number of precedents can be examined.

Technical issues. The technical issues include the specifications of the VMS units with particular regard to the minimum frequency for position reports and the requirement for polling and tamper proofing of the VMS units. Recognising the rapid advances in technology and possible decreases in costs in the longer term, it may be preferable to agree upon a relatively high standard and provide for a staged implementation to allow some vessels and FMCs to upgrade their VMS.

Data exchange formats and protocols will need to be agreed. Agreed data formats are required for catch reports and eventually for logbooks. Longer-term projects, such as electronic logs should be included on the VMS agenda giving members a degree of ownership of any national trials, or pilot projects for sub-regions.

Legal and administrative issues. The need for harmonisation, or equivalence in VMS legislation may required discussion. The Commission will need to agree upon the use and terms and conditions for use of VMS information by the Commission, including the provisions for confidentiality and data security. The interpretation of the terms 'simultaneous', 'directly', and 'near real time' may need to be specified.

5.1.1 Process

The process of developing the VMS may start be securing broad agreement on the functions of the VMS and related satellite communications with the fleet in the longer term. Consensus on the future scope of the system is important, with particular reference to future coverage of non-high seas areas, polling, possible effort control requirements, possible reporting of catch and entry/ exit by satellite communication and the relationship between the FFA and the Commission.

The second step is to identify: (i) the areas of broad agreement with respect to the scope and operation of the VMS; and (ii) the key issues which need to be resolved to proceed with a more detailed design. A working proposal describing the VMS is required to facilitate this discussion. A synthesis of information from a set of country papers describing the existing and planned national VMS can provide a clearer overview of the legal and technical issues.

Further detailed studies can be prepared in an effort to further build on consensus already developed, and to weigh the options in areas of disagreement, or uncertainty.

Based on broad agreement in all key areas a feasibility study can be commissioned followed by the preparation of functional specifications and eventual tenders.

5.1.2 Possible phases in VMS development

As approximately one third of the target fleet is already equipped with Inmarsat C and complies with the FFA standards, it is suggested that the FFA technical standards could be considered as a basis for discussion of the Commission's VMS technical requirements. The two-way communication ability and the polling facility are highly desirable features for the Commission's VMS and, if possible, should be an integral part of the VMS.

The technical development of the VMS is likely to be a phased process. The timelines of the phases could overlap for different groups of vessels, or for different sub-areas.

1. The initial phase would accommodate the current capabilities of both Argos and Inmarsat C in terms of a relatively low frequency of reporting and non-requirement for polling. Vessels using Argos may be subject to a higher level of non-VMS reporting.

2. The second phase would conform to the requirements of the FFA VMS in terms of frequency of reporting and requirement for polling. The polling facility of the new Argos satellites could be active by this time.

3. In a third phase, basic catch reporting (entry/ exit/ transhipment) would be introduced for certain groups of vessels, e.g. purse seiners, or with respect to certain areas, e.g. where there are concentrations of juveniles.

4. A fourth phase would have two objectives: the gradual introduction of standardised electronic catch reports to eventually substitute the paper forms; and pilot schemes for effort control if considered necessary for certain fleets, or species.

ANNEXES

6. ANNEX 1. REPORTED NUMBERS OF FISHING VESSELS WITH VMS IN THE CONVENTION AREA

Flag State	FFA[1]	Argos[2]	Total
Australia	2		2
Cook Islands	5		5
Fed. States of Micronesia	10	5	15
Fiji	49		49
Marshall Islands	6		6
New Zealand	8	50	58
Papua New Guinea	1		1
Kiribati	1		1
Vanuatu	61		61
Solomon Islands	3		3
Tonga		50	50
Sub-total FFA member states	**146**	**55**	**201**
China	112	30	142
Indonesia	1	1,500	1,501
Japan[3]	239	750	989
Republic of Korea	35	380	415
Philippines	47		47
Chinese Taipei[5]	247	230	477
U.S.A.[4]	21	650	671
Sub-total other Convention signatories	**702**	**3,540**	**4,242**
Belize	17		17
Cyprus	2		2
Estonia	1		1
Georgia	1		1
Democratic Republic of Korea	1		1
Malta	1		1
Netherlands Antilles	1		1
Panama	31		31
Seychelles	1		1
Singapore	10		10
Spain	2		2
St Vincent & The Grenadines	5		5
Sub-total third countries	**73**	**0**	**73**
Total	**921**	**3,595**	**4,516**

1. Numbers of vessels on the FFA VMS Register.
2. Approximate numbers of Argos VMS units in the signatory countries to the Convention. Not all Argos units are installed on tuna vessels, or on vessels operating in the Convention Area (information from CLS).
3. Japan has over 200 Argos units installed on tuna vessels.
4. United States of America: 145 Hawaii longline vessels use Inmarsat C; 21 WCP purse seiners use Inmarsat C
5. Chinese Taipei Southern Bluefin 60 vessels (mandatory); Tuna association indicative total of 600 vessels, of which an estimated 66% use Argos and 33% Inmarsat C.

7. ANNEX 2. EXAMPLES OF VMS REGULATIONS

7.1. LEGISLATIVE BASIS FOR VMS IN THE EUROPEAN UNION.

Extracted from: Council Regulation (EEC) No 2847/93 (subsequently amended)

1. Each Member State shall establish a satellite-based vessel monitoring system, hereinafter referred to as 'VMS', to monitor the position of Community fishing vessels.

2. The VMS shall apply no later than 1 January 2000 to all Community fishing vessels exceeding 20 meters (*now 18 meters*) between perpendiculars or 24 meters overall length wherever they operate.

3. Notwithstanding the provisions of paragraphs 1 and 2 above, the VMS shall not apply to vessels: (a) operating exclusively within 12 nautical miles of the baseline of the flag Member State; or (b) which never spend more than 24 hours at sea taken from the time of departure to the return to port.

4. When a Member State imposes VMS on vessels flying its flag and not falling within the scope of paragraphs 1 to 3, those vessels will be eligible for the same financial support as is applicable for vessels applying VMS under paragraphs 1 and 2.

5. Member States shall ensure that satellite-tracking devices be installed and be fully operational on Community fishing vessels flying their flag to which VMS shall apply. The satellite-tracking device shall enable a fishing vessel to communicate by satellite to the flag State and the coastal Member State concerned simultaneously, its geographical position and where applicable the effort reports referred to in Article 19b. In the case of *force majeure* relevant information shall be communicated by radio via a radio station approved under Community rules for the reception of such information or by the means specified in Article 19c.

6. The masters of the Community fishing vessels to which VMS applies shall ensure that the satellite-tracking devices are at any time fully operational and that the information referred to in paragraph 5 is transmitted. Transmission shall be carried out at the required daily frequency to ensure that the flag Member State and/or the coastal Member State can effectively monitor the vessels.

7. Member States shall establish and operate fisheries monitoring centres, hereinafter referred to as 'FMC', which shall monitor fishing activities and fishing effort. The FMC shall be operational no later than 30 June 1998.

The FMC of a particular Member State shall monitor the fishing vessels flying its flag, regardless of the waters in which they are operating or the port they are in, as well as Community fishing vessels flying the flag of other Member States and fishing vessels of third countries to which a VMS applies operating in the waters under the sovereignty or the jurisdiction of that particular Member State.

8. Each flag Member State shall appoint the competent authorities responsible for the FMC and shall take the appropriate measures to ensure that its FMC has the proper staffing resources and is equipped with computer hardware and software enabling automatic data processing and electronic data transmission. Member States shall provide for back-up and recovery procedures in case of system failure. Member States may operate a joint FMC.

9. The flag Member State shall take the necessary measures to ensure that the data received from its fishing vessels to which a VMS applies are recorded in computer-readable form for a period of three years.

The coastal Member State shall take the necessary measures to ensure that the data received from fishing vessels flying the flag of another Member State or of a third country to which a VMS applies are recorded in computer-readable form for a period of three years. The Commission shall have access to these computer files on the basis of a specific request. The provisions of Article 37 shall apply.

10. Detailed rules for the implementation of this Article shall be decided in accordance with the procedure laid down in Article 36. In particular, on the basis of an application by a Member State and in accordance with the provisions of Article 36, the Commission may decide that an alternative system to VMS may be applied, taking into account the type of monitoring system proposed, the type of fishing vessel or vessels, the area or areas fished, the targeted species and the duration of the fishing trips. The alternative system must be as effective as a VMS and apply on a non-discriminatory basis.

7.2. NEAFC COMPLIANCE SCHEME FOR CONTRACTING PARTIES

7.2.1 Map of the NEAFC area

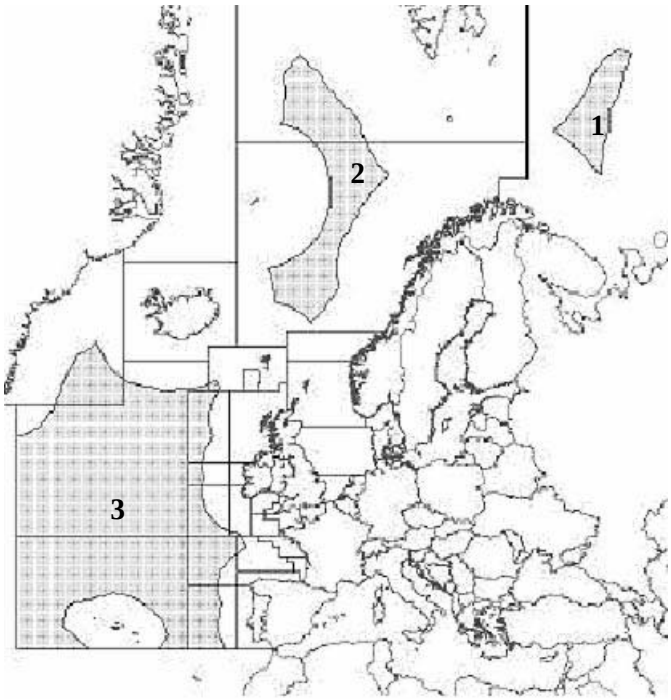

Figure 5. Map of the NEAFC area, showing the three high seas Regulatory Areas

7.2.2 NEAFC provisions on VMS

Article 9

Vessel Monitoring System

1. Each Contracting Party shall implement no later than 1 January 2000, a vessel monitoring system (hereinafter referred to as VMS) for its fishing vessels exceeding 20 metres between perpendiculars or 24 metres overall length which fish, or plan to fish, in the Regulatory Area and:

a) require its fishing vessels, fishing in the Regulatory Area, to be equipped with an autonomous system able to automatically transmit messages to a land-based fisheries monitoring centre (hereinafter referred to as FMC) allowing a continuous tracking of the position of a fishing vessel by the Contracting Party of that fishing vessel in conformity with the specifications and schedule set out in Annex VI;

b) ensure that the satellite device shall enable a fishing vessel to communicate by satellite to the Contracting Party messages relating to the following data:

- the vessel identification;
- the most recent geographical position of the vessel (longitude, latitude) with a position error which shall be less than 500 metres, with a confidence interval of 99%;
- the date and time of the fixing of the said position of the vessel;
- where applicable, data relating to the catch on board;
- where applicable, data relating to transhipment.

2. Each Contracting Party shall take the necessary measures to ensure that the FMC receives through the VMS the messages requested in paragraph 1(b).

3. Each Contracting Party shall ensure that the masters of fishing vessels flying its flag shall ensure that the satellite tracking devices are at all times fully operational and that the information in paragraph 1(b) is transmitted. In the event of a technical failure or non-operation of the satellite tracking device fitted on board a fishing vessel, the device shall be repaired or replaced within one month. After this period, the Master of a fishing vessel shall not be authorised to commence a fishing trip with a defective satellite tracking device.

Where a device stops functioning and a fishing trip lasts more than one month, the repair or the replacement has to take place as soon as the vessel enters a port, the fishing vessel shall not be authorised to continue or commence a fishing trip without the satellite tracking device having been repaired or replaced.

4. Each Contracting Party shall ensure that a fishing vessel with a defective VMS tracking device shall communicate, at least daily, reports containing the information in paragraph 1(b) to the FMC, by satellite or by other means of communication (radio, telefax or telex) in accordance with the format set out in Annex VII (5).

5. Contracting Parties shall, for the purpose of this scheme, co-operate with the Secretary in order to establish, before 1 January 1999, a data-base delimiting the Regulatory Area by latitude and longitude co-ordinates. This shall be without prejudice to each Contracting Party's position concerning the delimitation of sea areas under their sovereignty and jurisdiction.

ANNEX VI

Vessel Monitoring System (VMS)

1. Each Contracting Party of the vessel shall establish and operate fishing monitoring centers, hereinafter referred to as "FMC", which shall monitor the fishing activities of vessels flying their flags. The FMC shall be operational no later than 1 January 2000 and shall be equipped with computer hardware and software enabling automatic data processing and electronic data transmission. Each Contracting Party shall provide for back-up and recovery procedures in case of system failures.

2. The Contracting Party of the vessel shall take the necessary measures to ensure that the data received from its fishing vessels to which VMS applies are recorded in computer readable form for a period of three years.

3. The satellite tracking devices installed on board the fishing vessels shall ensure the automatic transmission to the fisheries monitoring center of the flag Contracting Party, at all applicable times, messages relating to the data prescribed in the NEAFC Control and Enforcement Measures Article 9(1)(b).

4. Each Contracting Party shall take the necessary measures to ensure that its FMC receives through the VMS, at least the mandatory information requested in Article 9(1)(b). The Contracting Parties concerned shall take the necessary measures to ensure that the NEAFC Secretary receives the position of the vessel in real time upon entering into or exiting from the Regulatory Area and at least once every two hours when operating in the NEAFC Regulatory Area. Reports shall be in accordance with the format set out in Annex VIII D.1.

7.2.3 NEAFC VMS pilot projects

Article 11

Contracting Parties may undertake Pilot Projects, which combine the use of daily electronic catch reports, two way communication between inspection vessels in the Regulatory Area and fishing vessels, and a reduction in the period of advance notification of entry and exit by fishing vessels from the area.

1. Scope

Only vessels of Contracting Parties that have the necessary technical facilities in place to send electronic "catch reports" are eligible.

Contracting Parties shall notify the Secretary of their intention to participate in a Pilot Project by 31 January 2004. They shall also notify the Secretary of the identification and contact details of the vessels participating in a pilot project.

2. Procedure

a) By way of derogation from the provisions of Article 10 masters of vessels taking part in the pilot project shall:

i) transmit the report foreseen in Article 10 a) at least 1 hour in advance of each entry in the Regulatory Area;

ii) transmit on a daily basis before midnight the catch reports provided for under Article 10 b);

iii) transmit the report foreseen in Article 10 c) at least 1 hour in advance of each exit from the Regulatory Area.

b) The FMC of a Contracting Party participating in a pilot project shall forward immediately upon receipt the reports referred to in paragraph a) to the Secretary.

c) The Secretary shall forward the reports received under paragraph b) to any inspection vessel or vessels which may be operating in the relevant geographical area of the Regulatory Area.

d) Any inspection vessel present in the relevant geographical area of the Regulatory Area may require fishing vessels, for no more than 6 hours from the time of transmission of the report:

i) not to start fishing, for reports referred to in Article 10(a);

ii) not to leave the Regulatory Area, for reports referred to in Article 10(c).

e) To this end the inspection vessel shall communicate to the Secretary the report "Prepare for inspection"set out in Annex X (C). The Secretary shall forward this report without delay to the FMC of the flag state of the vessel concerned which shall forward it to the vessel.

f) The master of a fishing vessel having received the report referred to in (e) shall comply with the requirements notified by the inspection vessel.

3. Evaluation

Each Contracting Party participating in a pilot project should submit a detailed report at the intersessional meeting of PECCOE in 2004 on its execution. On the basis of the results of the pilot project PECCOE may make appropriate proposals or recommendations.

Further details are available on the NEAFC website: www.neafc.org.

7.2.4 Forum Fisheries Agency

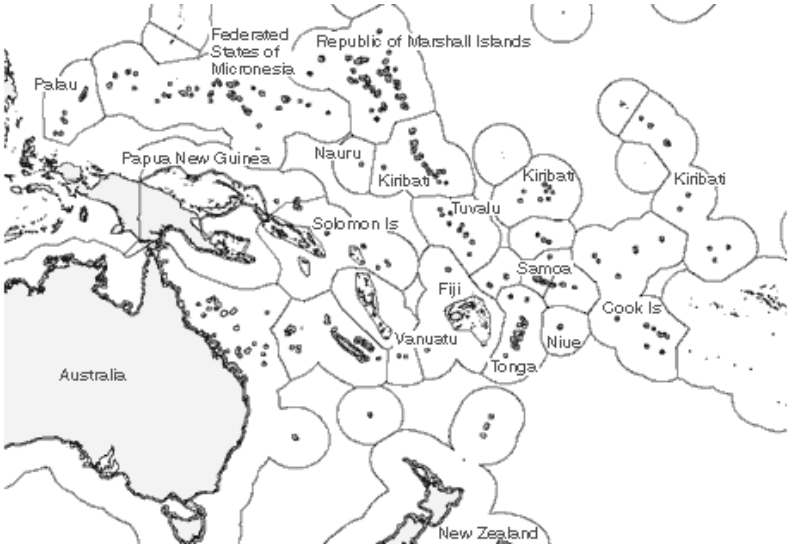

Figure 6. Map of the FFA area

7.2.5 Numbers of vessels in good standing on the FFA VMS Register (by flag)

Australia	2	Netherlands Antilles	1
Belize	17	New Zealand	8
China	112	Panama	31
Cook Islands	5	Papua New Guinea	1
Cyprus	2	Philippines	47
Estonia	1	Kiribati	1
Federated States of Micronesia	10	Vanuatu	61
Fiji	49	Seychelles	1
Georgia	1	Singapore	10
Indonesia	1	Solomon Islands	3
Japan	239	Spain	2
Democratic Republic of Korea	1	St Vincent & The Grenadines	5
Republic of Korea	35	Chinese Taipei	247
Malta	1	U.S.A.	21
Marshall Islands	6	**Total 29 flags**	**921**

7.2.6 The Harmonised MTC

From the the FFA Harmonised Minimum Terms and Conditions (MTC) for Foreign Fishing Vessel Access as amended by FFC53 (28 April – 8 May 2003)

14.Vessel Monitoring System

(a) The vessel monitoring system shall be implemented by the operation of a VMS Register of Foreign Fishing Vessels as set out in ANNEX 4 (b)The operator of a foreign fishing vessel shall apply for registration of the ALC on the prescribed form (ANNEXES 6 and 7) for each year and pay the prescribed fee; install and operate a registered ALC on board the vessel; and maintain the ALC in good working order. (c)The operator of a foreign fishing vessel shall not interfere with, tamper with, alter, damage or disable the ALC; move or remove the ALC from the agreed installed position without the prior permission of the licensing country; or impede the operation of the ALC.

(d) At least [*to be determined by the licensing country*] hours prior to entry into the exclusive economic zone of [*insert name of the licensing country*] the operator of a foreign fishing vessel shall ensure that the ALC is switched on and is operating properly at all times when the vessel is in the exclusive economic zone of [*insert name of licensing country*].

(e) The operator of a foreign fishing vessel or his or her authorized agent, upon notification by the [insert name of licensing country, appropriate authority] that the vessel's ALC has failed to transmit, shall ensure that position reports are communicated to [insert name of authority delegated by the licensing country/appropriate authority] in the manner set out in ANNEX 1.

(f) If it is not possible to make position reports, or if the [insert name of authority delegated by licensing country/appropriate authority] directs, the master of the vessel must immediately stow the fishing gear and take the vessel directly to a port as set out in ANNEX 1.

From summary of license conditions:

8. The operator of a foreign fishing vessel shall install, maintain and operate a registered ALC at all times and in accordance with the manufacturer's specifications and operating instructions and FFA standards.

9. The operator of a foreign fishing vessel shall ensure that no person tampers or interferes with the ALC and that the ALC is not altered, damaged or disabled.

10. The operator of a foreign fishing vessel shall ensure that the ALC is not moved from the agreed installed position or removed without the prior permission of the licensing authority.

The operator of a foreign fishing vessel shall ensure that the ALC is switched on and is operational at all times when the vessel is within the EEZ of the licensing country.

12. The operator of a foreign fishing vessel or his or her authorised agent, upon notification by the licensing country/ appropriate authority that the vessel's ALC has failed to report, shall ensure that reports containing the vessel's name, call sign, position (expressed in Latitude and Longitude to minutes of arc), and date and time of the report, are communicated to [insert delegated authority] at intervals of 8 hours or such shorter period as specified by the delegated authority, commencing from the time of notification of the failure of the ALC. Such reports must continue until such time the ALC is confirmed operational by the licensing country/ appropriate authority.

7.3. NORTHWEST ATLANTIC FISHERIES ORGANISATION

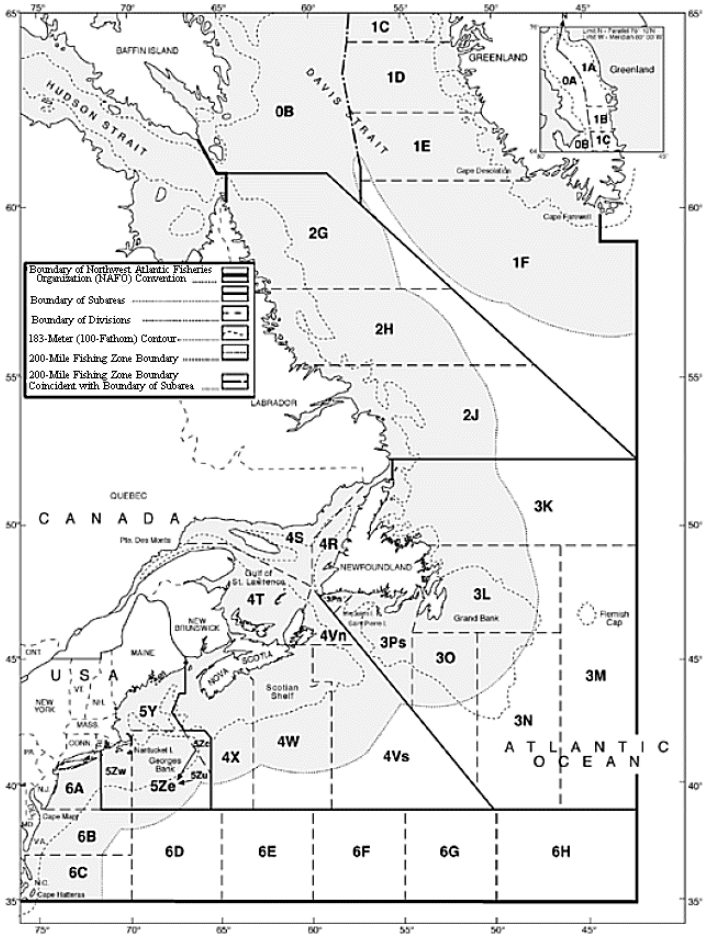

Figure 7. Map of the NAFO area

7.3.1 NAFO VMS measure

NAFO Article 21 - Vessel Monitoring System (VMS)

1. In order to improve and maintain compliance with the Conservation and Enforcement Measures for their vessels fishing in the Regulatory Area, fishing vessels operating in the Regulatory Area shall be equipped with a satellite monitoring device allowing the continuous reporting of their position by the Contracting Party. The satellite monitoring device shall ensure the automatic communication at least once every two hours to a land-based fisheries monitoring centre of the flag state (hereafter referred to as FMC) of data relating to:

a) the vessel identification;

b) the most recent geographical position of the vessel (longitude, latitude) with a position error which shall be less than 500 metres, with a confidence interval of 99%; and

c) the date and time of the fixing of the said position of the vessel.

The first transmitted position report in the Regulatory Area detected by the FMC of the Contracting Party shall be identified as "ENT". All subsequent position reports shall be identified as "POS" except the first position report detected outside the Regulatory Area which shall be identified as "EXI". If a Contracting Party so requests, the Secretariat shall confirm receipt of all electronic reports using a return message identified as "RET".

2. Each Contracting Party shall take the necessary measures to ensure that its FMC receives these data. The FMC of each Contracting Party shall be equipped with computer hardware and software enabling automatic data processing and electronic data transmission. Each Contracting Party shall provide for back-up and recovery procedures in case of system failures and shall take the necessary measures to ensure that the data received from its fishing vessels are recorded in computer readable form for a period of three years.

3. The masters of fishing vessels shall ensure that the satellite monitoring devices are at all times fully operational and that the information in paragraph 1 is transmitted to the FMC. In the event of a technical failure or non-operation of the satellite monitoring device fitted on board a fishing vessel, the device shall be repaired or replaced within one month. After this period, the master of a fishing vessel shall not be authorised to commence a fishing trip with a defective satellite monitoring device. Where a device stops functioning and a fishing trip lasts more than one month, the repair or the replacement has to take place as soon as the vessel enters a port and the fishing vessel shall not be authorised to continue or commence a fishing trip without the satellite monitoring device having been repaired or replaced.

4. Contracting Parties shall take the necessary measures to ensure that the master or the owner of the vessel or their representative is informed when the satellite tracking device fitted on board a vessel flying their flag appears to be defective or non-functioning.

5. Fishing vessels with a defective satellite monitoring device shall communicate, at least every 6 hours, reports containing the information in paragraph 1 to the FMC, by other means of communication (email, radio, facsimile or telex).

6. Contracting Parties shall communicate reports and messages pursuant to paragraphs 1 and 5 to the Executive Secretary as soon as possible, but not later than 24 hours after receipt of those reports and messages. If the Contracting Party so desires, its fishing vessels shall communicate reports (by satellite, email, radio, facsimile or telex) to the Executive Secretary. When the Executive Secretary has not received two consecutive position reports in accordance with paragraphs 1 and 5 and the vessel concerned has not reported that it has left the Regulatory Area the Executive Secretary shall automatically notify the FMC of the flag Contracting Party.

7. Contracting Parties shall ensure that the reports and messages transmitted between the Contracting Party and the Executive Secretary or between its fishing vessels and the Executive Secretary, shall be in accordance with the data exchange format set out in Annex IX.

8. The Executive Secretary shall make available as soon as possible the information received under paragraph 6 to other Contracting Parties with an inspection presence in the Regulatory Area. All reports and messages shall be treated in a confidential manner.

9. When an inspector observes a fishing vessel in the Regulatory Area and has not received data in accordance with paragraphs 1 or 5 he/she shall inform the master of the vessel and the Executive Secretary, who shall immediately inform the flag Contracting Party of the vessel.

10. Contracting Parties shall notify any changes of the name, address, telephone, telex, email and facsimile numbers of their competent authorities to the Executive Secretary without delay.

11. Subject to any other arrangements between Contracting Parties, each Contracting Party shall pay all costs associated with this system.

12. The elements of the VMS program are subject to review and revision, as appropriate, for application in 2004 and subsequent years.

7.3.2 NAFO communication of catches

NAFO Article 22 - Communication of Catches

1. Fishing vessels shall communicate electronically via the FMC to the Secretariat the following reports:

a) catch on entry into the Regulatory Area. This report shall be made at least six (6) hours in advance of the vessel's entry and shall include the date, time, geographical position of the vessel, total round weight by species (3 alpha codes) on board in kilograms (rounded to the nearest 100 kilograms) and directed species. This report shall be identified as COE;

b) catch on exit from the Regulatory Area. This report shall be at least six (6) hours in advance of the vessel's exit and shall include the date, time, geographical position of the vessel and catch in round weight taken and retained in the Regulatory Area by species (3 alpha codes) in kg (rounded to nearest 100 kilograms). This report shall be identified as COX;

c) each transhipment in the Regulatory Area. This report shall be made at least twenty-four (24) hours in advance and shall include the date, time, geographical position of the vessel and total round weight by species (3 alpha codes) to be transhipped in kilograms (rounded to the nearest 100 kilograms) and the call signs of vessels transhipped to and from. This report shall be identified as TRA;

7.3.3 NAFO VMS data format

NAFO Annex IX. VMS Data Format which is also the North Atlantic Format (NAF)

Data Element	Code	Mandatory /Optional	Remarks
Start record	SR	M	System detail; indicates start of record
From	FR	M	Address of the transmitting party (Contracting Party)
Address	AD	M	Message detail; destination; "XNW" for NAFO Secretariat
Sequence Number	SQ	O	Message detail; message serial number in current year
Type of Message	TM	M	Message detail; message type, "POS" as Position report/message to be communicated by VMS or other means by vessels with a defective satellite tracking device
Radio call sign	RC	M	Vessel registration detail; international radio call sign of the vessel
Trip Number	TN	O	Activity detail; fishing trip serial number in current year
Vessel Name	NA	M	Vessel registration detail; name of the vessel
External Registration Number	XR	M	Vessel registration detail; the side number of the vessel
Latitude	LT	M	Activity detail; position at time of transmission
Longitude	LG	M	Activity detail; position at time of transmission
Date	DA	M	Message detail; date of transmission
Time	TI	M	Message detail; time of transmission
Record Date	RD	M	Year, month and date
Record Time	RT	M	Hours and minutes in UTC
Record Number	RN	M	Serial number of the record in the relevant year
End of record	ER	M	System detail; indicates end of the record

Each data transmission is structured as follows: double slash ("//") and the characters "SR" indicate the start of a message; • a double slash ("//") and field code indicate the start of a data element; a single slash ("/") separates the field code and the data; pairs of data are separated by space; the characters "ER" and a double slash ("//")indicate the end of a record."

7.4. CCAMLR

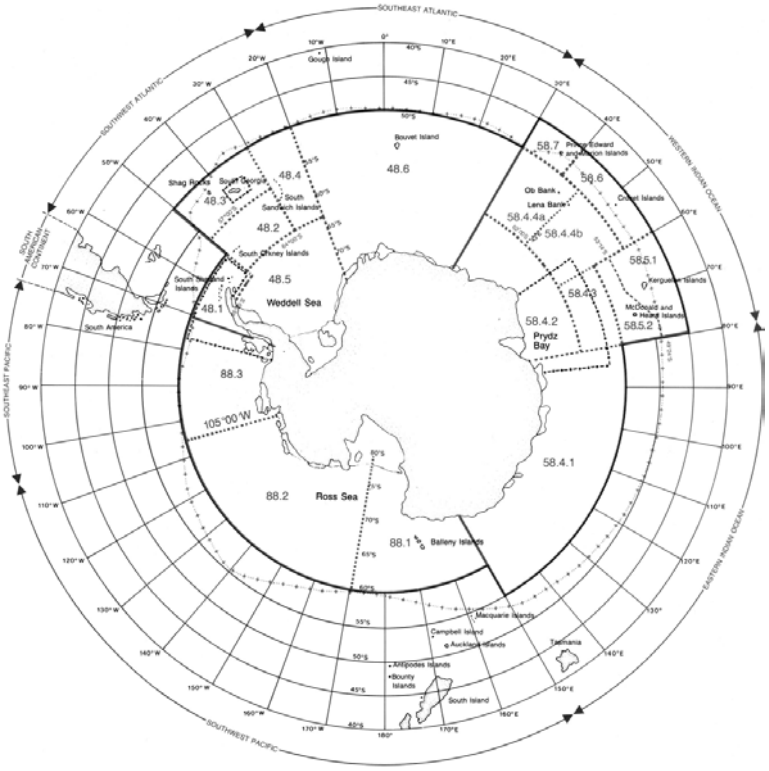

Figure 8. Map of CCAMLR area

7.4.1 CCAMLR Conservation measure 10-04 (2002)

CCAMLR CONSERVATION MEASURE 10-04 (2002)
Automated Satellite-Linked Vessel Monitoring Systems (VMS)

The Commission hereby adopts the following conservation measure in accordance with Article IX of the Convention:

1. Each Contracting Party shall maintain an automated Vessel Monitoring System (VMS) to monitor the position of its fishing vessels, which are licensed[1] in accordance with Conservation Measure 10-02.

2. The implementation of VMS on vessels while participating only in a krill fishery is not currently required.

3. Each Contracting Party, within two working days of receiving the required VMS information, shall provide to the Secretariat dates and the statistical area, subarea or division for each of the following movements of its flag fishing vessels:

(i) entering and leaving the Convention Area;
(ii) crossing boundaries between CCAMLR statistical areas, subareas and divisions.

4. For the purpose of this measure, VMS means a system where, *inter alia*:

(i) through the installation of satellite-tracking devices on board its fishing vessels, the Flag State receives automatic transmission of certain information. This information includes the fishing vessel identification, location, date and time, and is collected by the Flag State at least every four hours to enable it to monitor effectively its flag vessels;
(ii) performance standards provide, as a minimum, that the VMS:

(a) for both the hardware and software components, shall be tamper proof, i.e. shall not permit the input or output of false positions and must not be capable of being manually over-ridden;

(b) is fully automatic and operational at all times regardless of environmental conditions;

(c) provides real time data;

(d) provides the geographical position of the vessel, with a position error of less than 500 m with a confidence interval of 99%, the format being determined by the Flag State;

(e) in addition to regular messages, provides special messages when the vessel enters or leaves the Convention Area and when it moves between one CCAMLR area, subarea or division within the Convention Area.

5. Contracting Parties shall not issue licences under Conservation Measure 10-02 unless the VMS complies with paragraph 4 in its entirety.

6. In the event of technical failure or other non-function of the VMS, the master or the owner of the fishing vessel, as a minimum:

(i) shall communicate at least once every 24 hours, starting from the time that this event was detected, the data referred in paragraph 4(i) by telex, by fax, by telephone message or by radio to the Flag State;

(ii) shall take immediate steps to have the device repaired or replaced as soon as possible, and, in any event, within two months. If during that period the vessel returns to port it shall not be allowed to commence a further fishing trip without having the defective device repaired or replaced.

7. In the event that the VMS ceases to operate, the Contracting Party as soon as possible shall advise the Executive Secretary of the name of the vessel, the date, time and the location of the vessel when the VMS failed. The Party shall also inform the Executive Secretary when the VMS becomes operational again. The Executive Secretary shall make such information available to Contracting Parties upon request.

8. Contracting Parties shall report to the Secretariat before the start of annual meetings of the Commission, on the VMS which has been introduced in accordance with paragraphs 1 and 2, including its technical details, on:

(i) any change in the VMS;

(ii) in accordance with paragraph XI of the CCAMLR System of Inspection, all cases where they have determined, with the assistance of the VMS that vessels of their flag had fished in the Convention Area in possible contravention of CCAMLR conservation measures.

7.4.2 Additional CCAMLR measures referring to VMS

Catch documentation scheme for Toothfish. ……. any Contracting Party, or any non-Contracting Party participating in the Catch Documentation Scheme, may require additional verification of catch documents by Flag States by using, *inter alia*, VMS, in respect of catches[1] taken on the high seas outside the Convention Area, when landed at, imported into or exported from its territory.

Transhippment. The Commission agreed that, on a voluntary basis, subject to their laws and regulations, Flag States participating in the Catch Documentation Scheme for *Dissostichus* spp. should ensure that their flag vessels authorised to fish for or transhipping *Dissostichus* spp. on the high seas maintain an operational VMS, as defined in Conservation Measure 10-04, throughout the whole of the calendar year.[1] (RESOLUTION 16/XIX. Application of VMS in the Catch Documentation Scheme) [[1]This requirement does not extend to vessels of less than 19 m engaged in artisanal fisheries].

Suspected IUU vessels. Contracting Parties whose vessels are included in the draft list established by the Secretariat will transmit before 30 June to CCAMLR, their comments, as appropriate, including verifiable VMS data and other supporting information showing that the vessels listed have neither engaged in fishing activities in contravention of CCAMLR conservation and management measures nor had the possibility of being engaged in fishing activities in the Convention Area.

Crosschecking of VMS and catch documentation data. …. urges States participating in the CDS to ensure that *Dissostichus* Catch Documents (DCDs) relating to landings or imports of *Dissostichus* spp., when necessary, are checked by contact with Flag States to verify that the information in the DCD is consistent with the data reports derived from an automated satellite-linked Vessel Monitoring System (VMS)[1].

7.5. ICCAT, SRFC AND SWIO

7.5.1 ICCAT pilot VMS recommendation

THE INTERNATIONAL COMMISSION FOR THE CONSERVATION
OF ATLANTIC TUNAS (ICCAT) RECOMMENDS THAT:

1. Each Contracting Party with vessels greater than 24 meters in overall length (or greater than 20 meters between perpendiculars) and fishing for ICCAT species on the high seas outside the fisheries jurisdiction of any coastal state shall adopt a pilot program for a satellite-based vessel monitoring system (VMS) for ten percent of such vessels, or ten vessels, whichever is greater. The pilot program will be a flag-state based program.

2. Each Contracting Party shall implement a three-year pilot program effective 1 January, 1999; except the three year pilot program for vessels fishing in the Mediterranean, which shall be effective 1 January, 2000. Contracting Parties are encouraged to implement the pilot program earlier, if possible.

3. The pilot program shall not apply to vessels that never spend more than 24 hours at sea, counted from the time of departure from port to the time of return to port.

4. Information collected shall include the vessel identifier, location, date and time, which shall be collected with a required frequency to ensure that the Contracting Party can effectively monitor the vessel.

5. Performance standards shall at a minimum include a system that:

-- is tamper proof;

-- is fully automatic and operational at all times regardless of environmental conditions;

-- provides real time data; and

-- provides latitude and longitude, with a position accuracy of 500 m. or better, with the format to be determined by the flag state.

6. At its meeting in the year 2000, the Commission shall establish procedures on the submission of aggregate information and how the information is shared between Contracting Parties. These procedures shall ensure that appropriate measures are in place to ensure confidentiality.

7. By 1 June 1998, each Contracting Party shall submit to the Secretariat a report on anticipated implementation of its pilot program. Beginning in 1999, each Contracting Party shall report annually on the progress and implementation of its pilot VMS program. These reports shall be included in the annual national report.

8. The Commission shall evaluate the pilot program at its meeting in 2002.

7.5.2 SRFC VMS workshop recommendations

1. There was unanimous consensus that cooperation on VMS is necessary for several reasons including:

a) no one country can fully monitor the fleets operating in its own waters;
b) VMS provides improved monitoring of the movement of vessels in the sub-region;
c) VMS can help reduce IUU fishing in the Sub-Region;
d) VMS may provide more accurate evidence in the case of contested violations and conflicts between fishermen;
e) VMS may make the use of surveillance assets more effective, reduce surveillance costs and improve the cost-effectiveness of surveillance;
f) the presence of shared, straddling and highly migratory stocks makes cooperation essential in all domains of fisheries management;
g) individual vessels, in particular foreign flag vessels, operate in two, or more countries in the sub-region and VMS can assist in tracking such vessels;
h) the general weakness, or inexistence of surveillance assets in the countries;
i) VMS can assist in search and rescue operations.

2. Each country wished to have its own VMS system. In this manner, each country could proceed at its own pace with a gradual development of a secure data exchange network between member countries. A sub-regional protocol on information exchange could be considered, and the need for further work on the proposed sub-regional vessel register was noted.

3. Areas in which cooperation was considered necessary which included the following:

a) information exchange;
b) standardisation of equipment (in so far as practical);
c) harmonisation of legislation; and
d) training.

4. There was consensus that VMS should target industrial vessel, while monitoring development of suitable technical solutions for artisanal vessels.

5. The actions to be considered at national level include:

a) the VMS support systems (software, and/or equipment) installed in national FMCs must ensure inter-operability and compatibility with other national VMS systems and an ability to accept and interpret VMS signals from different satellite service suppliers;
b) inform the SRFC, and SOCU in particular concerning the choices of systems and results of pilot VMS schemes;
c) seek financing for VMS;
d) prepare suitable VMS regulations;
e) finalise national vessel registers;
f) inform vessel operators of the merits of VMS and seek their active cooperation in the design and establishment of such systems;
g) train VMS operators; and
h) conduct pilot VMS projects, feasibility and cost benefit studies in all countries.

6. The actions to be considered at Sub-Regional level include:

a) VMS to be considered as an integral part of sub-regional strategy;

b) harmonise VMS legislation. The Permanent Secretary to request the FAO Legal Office for such assistance bearing in mind that a request for 'regional project assistance' requires requests from at least three countries;
c) seek financial assistance for UCOS and enable the SRFC to fulfil its role;
d) prepare a draft protocol on the exchange of VMS information and a 'roadmap' for future development of VMS in the sub-region;
e) put the sub-regional vessel register in place; and
f) transfer of technologies and skills between countries.

7.5.3 SWIO VMS workshop recommendations

1. There was unanimity on the necessity of enhanced cooperation between SWIO countries on MCS in general and on VMS in particular. The reasons include:

a) To improve efficiency of MCS and fisheries management. VMS may make the use of surveillance assets more effective, reduce surveillance costs and improve the cost-effectiveness of surveillance.
b) To fulfil of international obligations with respect to fisheries.
c) To ensure consistency in reporting of exploitation of resource.
d) To improve in knowledge of the state of stocks.
e) To assist in unique vessel identification and establishment of a regional database(s) of fishing vessels.
f) To harmonise terms and conditions for reporting on fisheries.
g) To facilitate aggregation of data on fleets.
h) To provide an opportunity to harmonize requirements for VMS equipment and service providers.
i) To provide an opportunity to harmonize requirements for issuing of licenses.

2. Cooperation should focus not only on VMS, but also on a range of complementary MCS activities.

Information exchange:

a) establish a database of all vessels ;
b) establish automatic forwarding of VMS position (and catch on leaving EEZ) information between coastal states with particular reference to EEZ entry and exit information;
c) establish requirements for vessels to report position and catch from high seas areas, either to the coastal states or to IOTC, or other appropriate RFO.

Legal issues:

d) harmonise fisheries legislation as appropriate ;
e) seek means to make cooperative MCS initiatives effective even in the absence of settlement of boundary disputes;
f) seek legal advice on issues of international law such as the means of responding to requests from foreign governments to detain a vessel from a third party flag state for alleged fisheries violations; and
g) require VMS for all reefers and supply vessels ; and

Technical issues:

h) explore the possibilities of reducing tampering with VMS units on board the vessel.

8. ANNEX 3. THE BASICS OF VMS

8.1. HOW VMS WORKS

A typical VMS system involves four basic operations:

1. The fishing vessel receives its position from a Global Positioning System satellite (GPS)
2. The vessel sends its position coordinates to a VMS satellite. The VMS satellite retransmits this position information to an earth station.
3. The earth station sends the information through telephone lines, or other secure links, to the vessel owner and the Fisheries Monitoring Centre, or FMC.
4. The FMC sends the information to other users. In some systems the FMC, or the vessel owner, may also request the vessel to send its position information. This feature is known as 'polling'.

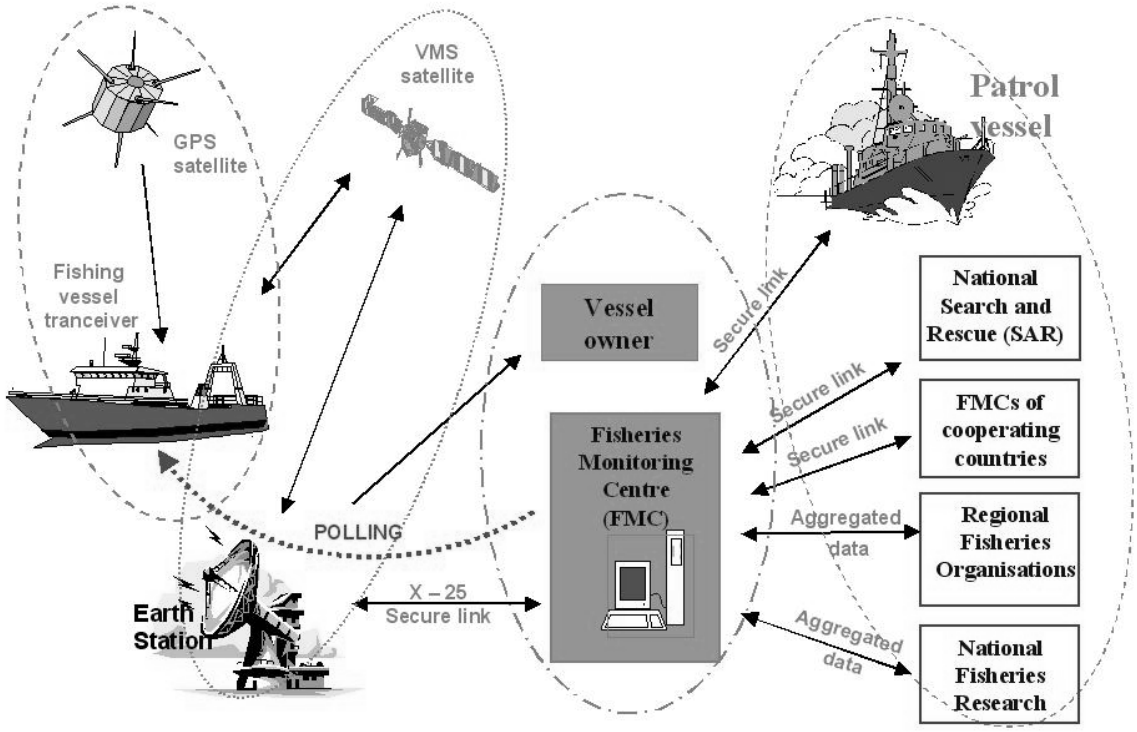

Figure 9. Model of a VMS

There are a number of variations on these transmission pathways. The vessel can send position information directly (via an earth station) to a regional fisheries organization. A range of other types of information can be sent via additional communications modules, such as email, which may be attached to the system.

Argos has global coverage. The footprint of the Inmarsat satellites to 76°N & S is illustrated below.

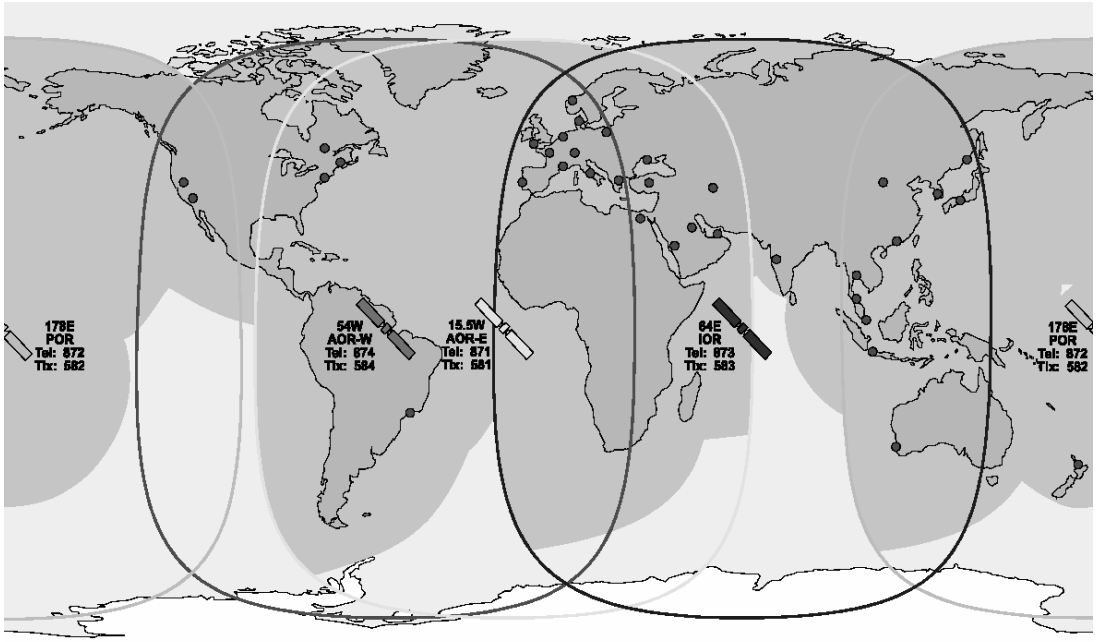

Figure 10. Footprint of the Inmarsat satellites

8.1.1 Summary of uses of VMS information

VMS is used extensively for tracking trucks, cargo containers and even private vehicles. VMS is also widely used by fishing companies to monitor the activities of their own vessels. VMS information is of considerable value to fisheries scientists. Inmarsat, one of the main VMS satellite networks was created specifically in the interests of vessel safety

Fisheries protection. VMS does not substitute for conventional fisheries monitoring, surveillance and enforcement. Aircraft, patrol vessels, seagoing observers and port controls are still required. However, VMS may make their use much more cost effective. VMS has particular utility for:

- control of fishing effort;
- control of protected/forbidden zones;
- detection and control of illegal landings;
- detection and control of illegal transshipments;
- increasing the efficiency and targeting of patrol vessels and aircraft;
- providing supporting evidence in prosecutions; and
- providing a powerful tool against and credible deterrent to illegal fishing.

IOTC has pointed out that, if a vessel, which is not on IOTC's positive list (i.e. non-IUU vessels), visits the harbour of an Indian Ocean coastal state, the vessel operator may have to prove it has not fished in the Indian Ocean. A VMS record may be the only way to prove that a vessel has not fished in an area. The situation may also certainly arise where a flag state national VMS monitoring centre is called upon to testify, from VMS records, that one of their vessels has not infringed fisheries regulations established by national authorities or international fisheries management organizations.

Resource management. VMS creates new possibilities for fisheries resource management in particular:

- calculation, allocation and control of fishing effort (and quotas);
- control of specific fishing areas and fleets;
- monitors the status of fisheries and fishing grounds, seasonally, yearly;
- enhanced verification through cross-checking cross-referenced with landing and research data;
- enables allocation of fishing effort and quotas;
- enhanced analysis of fisheries under pressure of over-exploitation; and
- potential information on use of fishing gears, bycatch and discards (gear sensors, video links).

At the service of industry.

- provides transparency and equality of treatment, or a 'level playing field' for all fleets;
- distribute data in real-time to assist operations;
- significantly improved safety at sea;
- the provision of an accurate navigation system ;
- enables conflict resolution through evidence regarding possible responsibility for destruction of gears; and
- the provision of secure communications allows transmission and receipt of catch and market information and even pre-sale of catch.

8.1.2 Synthetic aperture radar

Space borne imagery gives a real view of the vessels in a region, while VMS shows only those vessels using VMS. Studies in the EU have shown that space borne synthetic aperture radar (SAR) imagery could complement VMS by detecting and identifying non-compliant vessels. Work started in 1998 and led to a collaborative project in 2002.

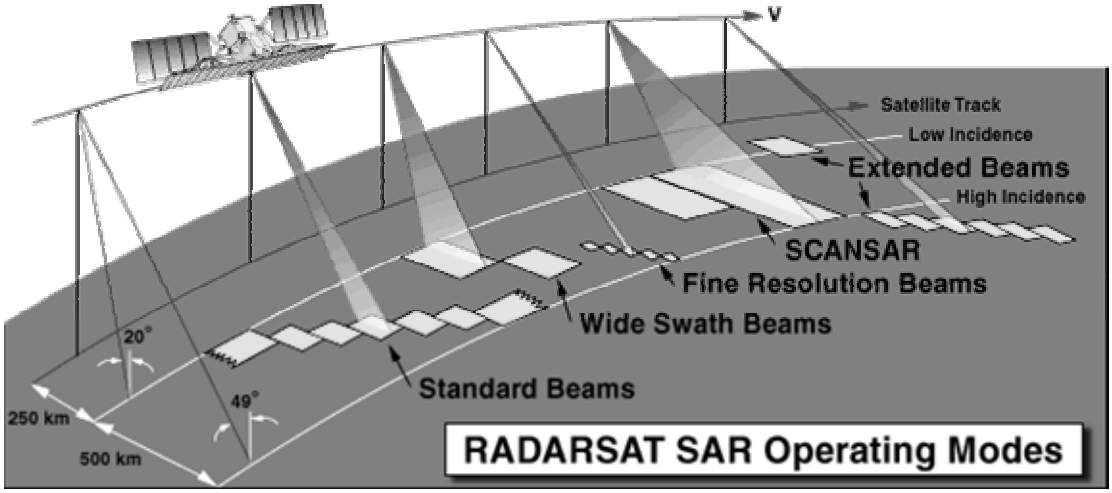

Figure 11. Synthetic aperture radar

Studies undertaken by the EU's Joint Research Centre (JRC) indicated a 92% success in identifying a vessels with standard detection procedure, if hourly VMS was available. The average distance between detected vessels and VMS was less than 0.3 nautical miles. The main reason for non-identification was low frequency of VMS reports. When VMS available with a report frequency of an hour or less the identification was unambiguous. The technology requires transmission of very large files (over 100 MB). There is a need to filter out non-fishing traffic, or vessels. Fiberglass vessels are not visible on ScanSAR. Sea conditions don't affect detection, with the exception of some very local turbulence.

Important JRC projects are under way in association with a large numbers of partners. IMPAST is exploring means of integrating the satellite imagery with the VMS systems and FMCs. DECLIMS is designed to improve the scientific basis for this technology.

8.1.3 Electronic catch and effort reporting

Electronic catch and effort reporting, also referred to as an electronic logbook is used in many countries including Norway, Iceland, Australia. Data transmission need not necessarily be made by satellite, but can be archived electronically on the vessel's computer. However near real time catch reporting can aid compliance.

Advantages	Disadvantages
• Availability of "near real time" data if sent by satellite • Fine scale spatial data • Increased data quality • Cost saving over traditional hard copy logbooks (printing, postage, data entry) • Enhanced tools for stock assessment • improved legibility and reduced data transcription errors • Reduction in paperwork for fishers • Value adding to industry (same/additional information to vessel operators/ markets) • Enhanced e-mail capabilities (if email used to send catch reports) • Operators have their own databases of the boats activity • Inclusion of "real-time" validation procedures at both the point of entry (the boat) and upon receipt. • Electronic cross-checking with VMS information	• Software development needed when logbook requirements change • Installation of software packages may incur problems • Hardware failure may cause loss of data, if not backed up • User resistance • Some boats are not equipped with personal computers • Life-span of PC is limited in a marine environment • Communication costs • Installations costs • Training • Some fishing vessels do not have computers. • Some computers not capable of supporting E-logs • Some computers may not have any spare RS323 ports. • Initial problems with software "crashing". • Software conflicts with other navigational plotting software. • Every computer system onboard a vessel is configured differently, making stable installation difficult. • Due to the marine environment computers are replaced regularly, requiring the software to be re-installed. • Fishers unfamiliar with the use of computers. • High turn-over of skippers resulted in decreased use.

Source: Adapted from: Martin Hicks, Electronic Catch & Effort Reporting. Queensland's Experience. Queensland Fisheries Service, Inmarsat VMS Conference, Cairns, 2003.

8.2. BASIC ELEMENTS OF VMS LEGISLATION

The agency responsible for the VMS should be designated and the its responsibilities described. VMS should be specified as a precondition for the issue of a fishing license, or authorization for particular classes of vessels, e.g. vessels over 24 meters, foreign vessels, tuna vessels. The fishing license holder and/ or master of the vessel should be made responsible for ensuring the VMS unit is fully operational and requested information transmitted regularly.

The VMS unit should have minimum performance standards, be tamper proof and not permit input of false positions or information. The VMS unit should be operational at all times. There should be approved modalities for installation and maintenance to ensure continuous reliable operation in conformity with minimum performance standards. The registration of the VMS unit may need to be specified to ensure a valid physical and legal link between vessel and VMS unit.

Position should be set to within a specific distance with a specified degree of accuracy. Frequency of position reporting should be specified, and if polling is required this should be specified. The to be transmitted and the formats or codes for transmission must be specified including the vessel identification, coordinates, date and time. Any other information to be transmitted must be specified, such as catch, and entry and exit hailing

Procedures in case of VMS unit failure should be prescribed to assure continuity of the reporting by vessels. The procedures should include: (i) notification procedures; (ii) require information through alternative communication system; (iii) specification of time period within which the VMS unit must be repaired/replaced. Offences and penalties should be specified. Offences must include all possible interference with the proper functioning of VMS. Penalties must be severe enough to deter violations.

It has been suggested that FAO prepare model VMS legislation.

8.3. NEAFC PROVISIONS REGARDING DATA SECURITY

PROVISIONS ON SECURE AND CONFIDENTIAL TREATMENT OF ELECTRONIC REPORTS AND MESSAGES TRANSMITTED PURSUANT TO ARTICLES 9, 10, 12 AND 16, AND TO ANNEXES VII, VIII AND XI OF THE SCHEME (ATTACHMENT V)

1. Field of application

The provisions set out below shall apply to all electronic reports and messages transmitted and received pursuant to Articles 9, 10, 12 and 16, and to Annexes VII, VIII and XI of the Scheme, hereinafter referred to as "reports and messages".

2. General Provisions

2.1 The Secretary and the appropriate authorities of Contracting Parties transmitting and receiving reports and messages shall take all necessary measures to comply with the security and confidentiality provisions set out in sections 3 and 4.

2.2 The Secretary shall inform all Contracting Parties of the measures taken in the secretariat to comply with these security and confidentiality provisions

2.3 The Secretary shall take all the necessary steps to ensure that the requirements pertaining to the deletion of reports and messages handled by the Secretariat are complied with.

2.4 Each Contracting Party shall guarantee the Secretary the right to obtain as appropriate, the rectification of reports and messages or the erasure of reports and messages the processing of which does not comply with the provisions of the Scheme.

2.5 Notwithstanding the provisions of Article 12.4 of the Scheme, the Commission may instruct the Secretary not to make available the reports and messages received under Article 12 of the Scheme to a Contracting Party, where it is established that the Contracting Party in question has not complied with these security and confidentiality provisions.

3. Provisions on Confidentiality

3.1 Reports and messages shall be used only for the purposes stipulated in the Scheme. No report or message transmitted and received pursuant to Articles 9, 10 and 12 shall be kept in a computer database at the Secretariat unless explicitly provided for in the Scheme.

3.2 Each inspecting Contracting Party shall make available reports and messages only to their means of inspection and their inspectors assigned to the Scheme.

3.3 The Secretary shall delete all the original reports and messages transmitted and received pursuant to Articles 9, 10 and 12 from the database at the Secretariat by the end of the first calendar month following the year in which the reports and messages have originated. Thereafter the information related to the catch and movement of the fishing vessels shall only be retained by the Secretary, after measures have been taken to ensure that the identity of the individual vessels can no longer be established.

3.4 The Secretary shall not make available reports and messages to other parties than those specified explicitly in Article 12.4 of the Scheme.

3.5 Inspecting Contracting Parties may retain and store reports and messages transmitted by the Secretary pursuant to Article 12.4 until 24 hours after the vessels to which the reports and messages pertain have departed from the Regulatory Area without re-entry. Departure is deemed to have been effected six hours after the transmission of the intention to exit from the Regulatory Area.

4. Provisions on security

4.1 Overview

Inspecting Contracting Parties and the Secretariat shall ensure the secure treatment of reports and messages in their respective electronic data processing facilities, in particular where the processing involves transmission over a network. Contracting Parties and the Secretariat must implement appropriate technical and organisational measures to protect reports and messages against accidental or unlawful destruction or accidental loss, alteration, unauthorised disclosure or access, and against all inappropriate forms of processing. The following security issues must be addressed from the outset:

- System access control: The system has to withstand a break-in attempt from unauthorised persons.
- Authenticity and data access control: The system has to be able to limit the access of authorised parties to a predefined set of data only.

- Communication security: It shall be guaranteed that reports and messages are securely communicated.
- Data security: It has to be guaranteed that all reports and messages that enter the system are securely stored for the required time and that they will not be tampered with.
- Security procedures: Security procedures shall be designed addressing access to the system (both hardware and software), system administration and maintenance, backup and general usage of the system.

Having regard to the state of the art and the cost of their implementation, such measures shall ensure a level of security appropriate to the risks represented by the processing of the reports and the messages. Security measures are described in more detail in the following paragraphs.

4.2 System Access Control

For their main computer systems the Contracting Parties and the Secretariat shall aim to meet the criteria of a C2-level trusted system, (as described in Section 2.2 of the U.S. Department of Defence Trusted Computer System Evaluation Criteria (TCSEC), DOD 5200.28-STD, December 1985).

The following features are some of the ones provided by a C2-level trusted system:

- A stringent password and authentication system. Each user of the system is assigned a unique user identification and associated password. Each time the user logs on to the system he/she has to provide the correct password. Even when successfully logged on the user only has access to those and only those functions and data that he/she is configured to have access to. Only a privileged user has access to all the data.
- Physical access to the computer system is controlled.
- Auditing; selective recording of events for analysis and detection of security breaches.
- Time-based access control; access to the system can be specified in terms of times-of-day and days-of-week that each user is allowed to login to the system.
- Terminal access control; specifying for each workstation which users are allowed to access.

4.3 Authenticity and Data Access Security

Communication between the Contracting Parties and the Secretariat for the purpose of the Scheme shall use the X.25 Protocol. Where E-mail is used for general communication and reports outside the scope of provision 1.1. between the Secretariat and the Contracting Parties the X.400 Protocol shall be used.

4.4 Communication Security

If Contracting Parties and the Secretariat agree, the X.400 Protocol can be used for communication of data under the Scheme, but then appropriate encryption protocols like “Pretty Good Privacy” (PGP) or “Digital Encryption Standard” (DES) shall be applied to ensure confidentiality and authenticity.

4.5 Data Security

Access limitation to the data shall be secured via a flexible user identification and password mechanism. Each user shall be given access only to the data necessary for his task.

4.6 Security Procedures

Each Contracting Party and the Secretary shall nominate a security system administrator. The security system administrator shall review the log files generated by the software, properly maintain the system security, restrict access to the system as deemed needed and act as a liaison with the Secretariat in order to solve security matters.