SECTION II

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Report of the Meeting of the STACTIC Working Group on Satellite Tracking 2-4 April 1997 Dartmouth, N.S., Canada

Report of the Meeting of the STACTIC Working Group on Satellite Tracking

(FC Doc. 97/2)

2-4 April 1997
Dartmouth, N.S., Canada

This intersessional meeting was held in accordance with the decision by the Fisheries Commission (FC Doc. 96/13, Part I, item 3.2(c)) to convene a meeting of technical experts.

1. Opening of the Meeting

The Chairman, David Bevan (Canada), opened the meeting and welcomed all delegates (Annex 1).

2. Appointment of Rapporteur

Tony Blanchard (Canada) was appointed Rapporteur.

3. Adoption of Agenda

The terms of reference for the meeting were reviewed and after some discussion the agenda was adopted with item six amended as per attached. (Annex 2)

4. Report by delegates on their national programs and implementation of the NAFO Satellite Tracking Program during 1996

Reports by delegates of their national programs started with a presentation of Working Paper 97/1 by the delegate from Norway (Annex 3). The EU delegate questioned at what point the hail message is sent to the NAFO Secretariat, from the fishing vessel or from the Directorate of Fisheries. The Norwegian delegate responded that the data is uploaded to the Directorate of Fisheries system automatically. The monpol monitor reads position reports and determines whether the position falls in another countries EEZ or within a Statistical area (NEAFC or NAFO). This position is compared to the most recent position and if the move is sufficient to warrant a hail the hail is automatically generated and uploaded to the NAFO Secretariat. The Danish (Greenland) delegate asked if Norway has considered making systems tamper proof. The Norwegian delegate stated that they have not been able to address this question in detail but it is scheduled to be addressed in the domestic Norwegian large scale trials in 1997.

The Executive Secretary presented the NAFO Secretariat's report to the Meeting, Working Paper 97/2 (Annex 4). He emphasized that the most important component would be to combine the Satellite Tracking systems with the hail system making it less expensive and more manageable. The Norwegian delegate asked if hails from Norway or any Contracting Party could be uploaded to an X.25 subaddress. The Executive Secretary responded that he believes that there is the technology to develop a standardized format and we could go ahead with this as a Pilot Project. It was decided to refer this discussion to agenda item 6.

The delegate from Iceland presented its report, Working Paper 97/3 (Annex 5). The EU delegate questioned whether or not Iceland has attempted to send hail messages to the NAFO Secretariat and if so whether the message was generated at the vessel or earth station. The delegate from Iceland responded that they have not sent hail messages to date.

The delegate from Canada presented its report, Working Paper 97/4 (Annex 6). The Norwegian delegate questioned the security of using the internet. The Canadian delegate responded that they were in the early stages of the investigation into the security issue but no problems have been encountered so far. The EU delegate asked whether the system transmits only position reports or if hail reports were also sent. The Canadian delegate responded that hails were also sent, and there was no automation of the hails. A decision will be taken regarding automation of hails.

The delegate from Russia presented its report, Working Paper 97/5 (Annex 7). The EU delegate questioned how many Russian vessels in the NRA were equipped with satellite tracking. The Russian delegate responded that to date one vessel is working in the NRA. This vessel does not have a satellite tracking system.

The delegate from the EU presented its reports, Working Papers 97/6 and 97/7 (Annexes 8 and 9). The Norwegian delegate questioned whether the EU has considered an expansion of their system to send messages automatically, possible through X.25 or X.400 and if any problems had been experienced. The EU was not aware of any bugs in the system. The Danish delegate (Greenland) questioned whether the EU will require fishing vessels to communicate data to the Contracting Party and the NAFO Secretariat simultaneously. If so, this would put a burden on the vessels and require standardization and exclude some carriers. The EU delegate responded that domestically several ways have been identified to notify the Flag State and Coastal State simultaneously with one message being dispatched to two addresses. The same type of system could be developed for NAFO if this became a requirement in the future. The Icelandic delegate questioned if the EU system was transmitting positional data only. The EU responded that each member state is different and the political agreement is only to transmit positional data. In the future, the VMS system could be amended to include catches.

The Danish (Greenland) delegate stated that because Greenland had approximately 160 days fishing in the NRA, and 100% observer coverage they are not undertaking a satellite tracking program. He further stated that observers could deal with a wider range of conservation issues than satellite tracking. The delegate of Denmark was unable to provide information on the implementation of the satellite tracking by the Faroe Islands.

The delegate from USA stated that no vessels from the USA have fished the NRA but may do so in the future. Domestically the USA has approved satellite tracking if it meets the following conditions: it is tamper proof, it is automatic and in operation at all times, it is capable of tracking a vessel to within 400 meters, sends an hourly position, enables communication from ship to shore, responds to polling within 15 minutes, has 9600 baud ASCII format and will archive data for one year. Two systems have been approved; BoaTracs and Trimble Galaxy Inmarsat-C system. All the positional information is stored at the National Marine Fisheries Service and not provided to Enforcement vessels. Discussions are in progress to allow access to the information by enforcement vessels. The EU delegate stated that the polling requirement excluded a particular service provider and asked if this was needed. The US responded that polling is a useful characteristic that will remain a requirement. The Norwegian delegate asked if the USA had any experience with the coverage of the BoaTracs system in the NRA. The USA delegate stated that it had no experience in the NRA and was not sure if the coverage extends to 3M.

The delegate from Denmark asked the Executive Secretary if there was any information from the Baltic States (Estonia, Latvia, Lithuania). The Executive Secretary stated that the Secretariat has not received any information from the Baltic States except hail information by fax, and some indication from the Argos satellite system of France that they were working with the Baltic countries to equip their vessels.

5. Costs associated with implementation of satellite tracking by Contracting Parties

While more detailed costs were described in the working papers, it was noted that there were a variety of costs ranging from $3,500 US to $12,000 US for an Inmarsat-C system. There was general agreement that costs were dropping significantly and the specific costs were unknown until a specific competitive tender was called.

6. Recommendation of hardware and software which should be installed at the NAFO Secretariat and, as appropriate, standardization of the report format

There was considerable discussion on the mandate of the Working Group. It was noted that the Fisheries Commission had mandated this Working Group to deal with the infrastructure at the NAFO Secretariat. It was further noted that according to the current NAFO Conservation and Enforcement Measures, the NAFO Secretariat is involved only in the receipt and transmission of hail reports. It was also noted that information pertaining to the geographical disposition of the fleet through satellite tracking positional information should be dealt with through direct bilateral cooperation between Contracting Parties, pursuant to Part VI section B.1.e of the NAFO Conservation and Enforcement Measures.

A number of Contracting Parties noted that technology exists that if acquired could make it possible to transmit data between fishing vessels and the NAFO Secretariat and have the Secretariat retransmit to Contracting Parties with an inspection presence in the NRA. These Contracting Parties further noted that standardized formats may be the least expensive approach to achieve this. However, technically, standardized formats are not required. Another Contracting Party noted that the Secretariat could be equipped with an appropriate system to recognize and interpret different formats.

While no consensus was reached on recommendations to take forward to the Fisheries Commission, several Contracting Parties might be willing to enter into arrangements with the NAFO Secretariat to electronically transmit hail information. Due to the limited mandate noted above there was no consensus on what new equipment and software should be provided to the NAFO Secretariat to accommodate this. The EU delegation stressed, however, that at present the European Union is the only Contracting Party to make available hail reports in a computer readable form on the basis of an agreed file format since 1994. The Working Group however wishes to bring to the attention of the Fisheries Commission that it is technically possible and relatively inexpensive to transmit in near real time any relevant information to the NAFO Secretariat and Contracting Parties with inspection vessels in the Convention Area.

7. Costs associated with implementation of satellite tracking by the NAFO Secretariat

Cost associated with recommendations have not been estimated. The Secretariat will work with Contracting Parties transmitting or wishing to transmit electronic data to the Secretariat, in order to determine costs and equipment requirements.

8. Recommendations to the Fisheries Commission and General Council (finance)

The Working Group recommended that the Fisheries Commission define the information needs and its distribution so that detailed proposals on equipment and software requirements and their associated costs can be developed by STACTIC.

9. Other Business

The delegations had an opportunity to observe the operation of the hail system at the NAFO Headquarters and in particular, to view the electronic retrieval, forwarding and storage of the hails.

10. Adjournment

The Report was adopted by the Working Group and forwarded to the Fisheries Commission. The meeting was adjourned at 1215 April 4, 1997.

Disposition of Report

The Report was reviewed by Representatives of the Fisheries Commission during 08 April - 07 May 1997. Having presented and incorporated some editorial corrections, the Report was adopted by the Fisheries Commission.

Annex 1. List of Participants

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Annex 2. Agenda

1. Opening of the Meeting by the Chairman, D. Bevan (Canada)
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Report by delegates on their national programs and implementation of the NAFO Satellite Tracking Program during 1996
5. Costs associated with implementation of satellite tracking by Contracting Parties
6. Recommendation of hardware and software which should be installed at the NAFO Secretariat and, as appropriate, standardization of the report format.
7. Costs associated with implementation of satellite tracking by the NAFO Secretariat
8. Recommendations to the Fisheries Commission and General Council (finance)
9. Other business
10. Adjournment

Annex 3. Norwegian Satellite Tracking System - NAFO 1996/97

1.1 Equipment on board vessels

It was a decision by Norway that all of her vessels taking part in the Flemish Cap shrimp fisheries for 1996 should carry satellite tracking devices suitable for the NAFO trials.

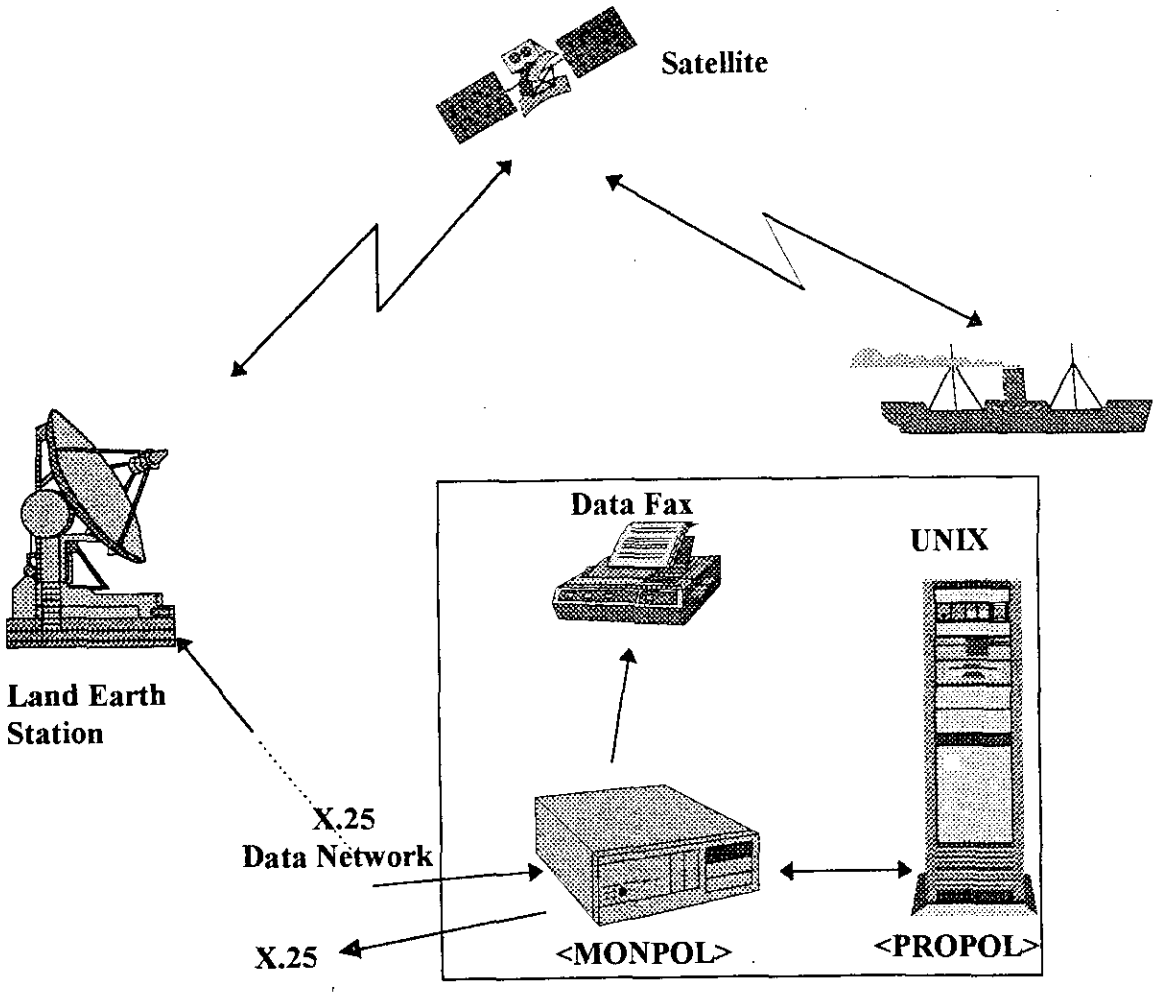
Out of 32 relevant Norwegian fishing vessels, about half were found to have Inmarsat-C equipment already installed before the start of the NAFO trials. Such equipment were, however, acquired for reasons other than tracking, and a fair amount of testing would be necessary to ascertain that tracking would work satisfactory. In the event not all those vessels chose to take part in the NAFO fisheries in 1996.

It was decided that a subsidy of NOK 20 000 (US $3 000) should be provided by the Directorate of Fisheries for vessels buying their own tracking devices specifically to participate in the Flemish Cap shrimp fisheries. If the ship owner was not interested in buying such equipment, suitable tracking devices of the most inexpensive type would be provided by the Directorate of Fisheries at no cost to the vessel, for the duration of the trials.

During 1996, 6 ship owners took up the option to buy Inmarsat-C units specifically for the NAFO trials. Including 10 vessels which had Inmarsat-C already installed, this raised the number of Inmarsat-C units commissioned to 16. A total of 7 vessels had at any one time installed Argos units provided by the Directorate of Fisheries for tracking purposes, and 1 vessel had also installed Euteltracs equipment. One vessel first installed an Argos-GI unit, but later acquired Inmarsat-C equipment.

It was required that the tracking equipment should be operational before a vessel could sail for the NAFO area. The maximum number of Norwegian vessels active simultaneously in the NAFO area during 1996 reached 15 by mid July, as compared to a total of 23 vessels commissioned.

Be aware that the number of vessels is not equivalent to the number of satellite units. The reasons for this is that one of the vessels did carry two sets of equipment. It was anticipated that the Euteltracs system could not operate without interruptions in the Regulatory Area. As the necessary mechanism for automatic data exchange between the European and the Canadian systems had not been established by the time the vessel left for Flemish Cap, the vessel with Euteltracs equipment therefore also carried an Argos transmitter. All Hails forwarded from Norway to the Executive Secretary for this vessel were generated based on the Argos position reports.



1.2 Equipment at the Directorate of Fisheries

By the time of the 1995 NAFO Annual Meeting, the Directorate of Fisheries had already carried out a number of trials on satellite tracking of fishing vessels. An experimental system was therefore operational, whereby the Directorate of Fisheries could handle data both from Inmarsat-C and Argos on a 'real time' basis. The Directorate of Fisheries was also familiar with the Euteltracs system, although the Euteltracs position reports had to be uploaded to the Directorate of Fisheries via modem and a telephone connection, as Eutelsat could not provide a X.25 delivery service.

Basically, Argos and Euteltracs position reports have been collected by the service provider and reported to the customer (i.e. the Directorate of Fisheries) in batches. The Inmarsat-C position reports can be obtained in two ways, either as scheduled reports initialised by the vessel, or as reports initialised by request from a control centre (e.g. the Directorate of Fisheries). It is often held that the second option is the better. The second option provides what is called *Polled Data Reports*. The Inmarsat-C system allows polls for position reports to be issued to a specific vessel, or to a pre-defined group of vessels.

The system at the Directorate is set up in two parts. The first part <PROPOL> runs on a UNIX computer, and issues polls for position reports. Incoming position reports are also logged by this system, which then decides whether further action, such as the issuing of a Hail Report to a third party, must be initialised. With specific intervals, for the time being every 15 minutes, the system reads an operator-defined table to find out whether polls for position reports shall be issued over the Inmarsat-C system, and decides which satellite and *Land Earth Station* (LES) should be used. <PROPOL> can handle both Argos, Euteltracs and Inmarsat-C position reports.

The second part of the system <MONPOL> takes care of all actual data communication. <MONPOL> runs on one or more PCs. Basically X.25 is the preferred communication protocol. All Inmarsat-C traffic is handled via X.25, and all Argos data reports are submitted to the Directorate of Fisheries via X.25. A format for X.25 was agreed with Euteltracs, but no data on this format was received during 1996. The actual transmission of outbound Hails from <PROPOL>, in this trial the Hails to the NAFO Executive Secretary, is also handled by the <MONPOL> system. For the 1996 NAFO trials, such Hails were submitted by facsimile.

As the <MONPOL> system reads all incoming position reports and transcribes them to a standard format before uploading to <PROPOL>, the <MONPOL> system has been equipped with a module to decide which geographical area a specific position refers to. This may be a *National Economic Zone (NEZ)*, or as in the case of the NAFO trials, a statistical subdivision.

1.3 The Hailing System

NAFO/FC Doc. 95/24 made no specific recommendations as to the format and standards to be followed for the reporting of Hails. It did, however, in section 8, list Universal Time Count (UTC) and World Grid System 84 (WGS-84) as possible options. Further, it drew the attention to the EU format developed by Denmark and Spain for use in data exchange.

The Norwegian party therefore decided to use those standards as a starting point. It was, however, apparent that the EU format did not cover all the data elements necessary for a NAFO hailing systems. Two new data elements were therefore introduced:

Field Code RC(new) - Radio Call Sign
Field Code RA(new) - Reporting Area
Field Code XR would refer to Vessel Side Number

It was decided that the satellite devices on board the Norwegian vessels should trigger an automatic Hail message every time a vessel crosses a subdivision line, whether this be between divisions or between divisions and outside the Convention Area. Although the system was capable of generating e.g. EXIT Hails specifically, it was decided that the Hail should in all cases be MOVE, to be reported in Field Code TM.

No effort was made to hail a crossing from the Regulatory Area into a NEZ.

As character set, the international ISO 8859.1 standard was adopted. In addition we took the liberty of reporting longitude (LO) and latitude (LA) according to the universally accepted decimal format, as this is better suited for handling by computer.

X.25 was our first choice as reporting media, with possible use of X.400 E-mail as a second best solution. As the X.25 installation at the NAFO Secretariat was not fully operational by mid February 1996, it was decided to use facsimile as reporting medium instead.

In retrospect, we have come to the conclusion that it would have been preferable to also include a Field Code SQ (new) for Sequence Number in the reporting format. This was not included for the 1996 trials, but was incorporated in the format for use in 1997.

An example of a 1996 hail message submitted by facsimile is given in Appendix 1.

2.1 Recent Developments

During the North Atlantic Fisheries Ministers Conference (NAFMC) meeting in Reykjavik in 1996, it was decided that an informal working group should report to the 3rd ministerial conference on current developments towards the application of common standards for the exchange of catch, position and activity data in the North Atlantic region, incorporating reference to work in NAFO and other relevant international organizations.

The Working Group should in particular aim at developing a standard for registration of catch and electronic data exchange that is compatible for both control and business use.

The NAFMC Working Group met in Torshavn 23-24 October, with delegates from Canada, the European Union, the Faroe Islands, Greenland, Iceland, Norway and Russia.

The Working Group inter alia decided to draw the attention of the Fisheries Ministers to the following:

A possible North Atlantic standard format for activity reporting and data interchange can be constructed by expanding the EU (Danish/Spanish) format to include other relevant data elements, for example those mentioned in the 1995 NEAFC report. If this approach is taken, efforts should be made to identify a body or organization which could accept responsibility for drafting and maintaining such a standard.

The Working Group also recommended that work on developing common standards, as proposed in the (Reykjavik) Communiqué, should continue.

At about the same time the Norwegian Directorate of Fisheries had accepted responsibility to organize the fisheries administration part of the Norwegian domestic trials on the use of satellite systems for fisheries purposes. As one of the main elements of these trials would be test automatic messaging systems, the Directorate of Fisheries decided that instead of starting off by defining a domestic format for the purpose of the trials, a better solution would be to try to adapt the recommendation of the NAFMC Working Group.

One comparatively great advantage with following this lead is apparent in the fact that a reporting scheme based on the EU (Danish/Spanish) model is not rigid, in the way that it does not assume a pre-defined array of elements to be reported. Rather, it allows elements to be added or taken away like building blocks, so as to set up messages tailored to specific needs with proper reference to the standard (re NAFO/FC Doc. 95/24, Annex 8).

The Directorate of Fisheries has consequently made an effort to define a number of data elements not included in the original EU (Danish/Spanish) proposal, enabling us to use this format as a basis for our domestic tests as well. A PC program <SATRAP> has been developed to set up messages according to this format for testing purposes, and matching data programs have been installed at the Directorate to cater for the automatic handling of incoming messages on a machine readable form. Although the Norwegian sea trials with this system is just about to start, one may hope that such trials could prove of value in setting up specifications for possible reporting schemes.

The EU Message Format as adapted to the Norwegian trials is outlined in Appendix 2.

It is the Norwegian view that to be of maximum value, a reporting scheme should be based on widely recognized standards. It should preferably operate equally well both in an E-mail environment (e.g. X.400) as well as implemented directly in a lower level protocol (e.g. X.25). In addition, the problem of authenticity is central to all automatic reporting schemes. Such problems are best resolved on an international basis.

APPENDIX 1: EXAMPLE OF HAIL MESSAGES

TELEFAX

From: The Norwegian Directorate of Fisheries Bergen, 96-07-02 06:21
To: NAFO Executive Secretary

Re PILOT PROJECT FOR SATELLITE TRACKING (B.1.d)

Here are one or more HAILS regarding Norwegian fishing vessels,
as reported directly by computer

//SR//FR/NOR//AD/NAFO//RC/XXXX//XR/YYYY//NA/ZZZZ/
/FS/NOR//TI/044400//DA/960702//TM/MOVE//AC///RA/3L/
/LA/47.731//LO/-046.528//SP/110//CO/273//ER//

//SR//FR/NOR//AD/NAFO//RC/xxxx//XR/yyyy//NA/zzzz/
/FS/NOR//TI/044400//DA/960702//TM/MOVE//AC///RA/3M/
/LA/48.859//LO/-042.040//SP/87//CO/274//ER//

This is a copy of a real facsimile sent to the NAFO Executive Secretary. For reasons of anonymity, RC, XR and NA are given as XXXX, YYYY, ZZZZ and xxxx, yyyy, zzzz respectively for the two vessels.

APPENDIX 2: The EU Message Format as adapted to Norwegian trials

Draft Version 0.94E - February 1997

Field Code	Name	Type	Contents
SR	Start of Record	-	
FR	From	CHAR*5	ISO-3/NAFO/NEAFC
AD	Addressee	CHAR*5	ISO-3/NAFO/NEAFC
IR	Internal Register no	CHAR*12	(EU)
XR	External Register no	CHAR*12	Side Number
NA	Vessel Name	CHAR*30	ISO 8859.1
FS	Flag State	CHAR*3	ISO-3
DA	Date	NUM*6	YYMMDD
TI	Time	NUM*6	HHMMSS(UTC)
LA	Latitude (degrees)	SNUM*8	±99.9999 (WGS-84)
LO	Longitude (degrees)	SNUM*9	±999.9999 (WGS-84)
SP	Speed	NUM*3	Knots*10
CO	Course	NUM*3	360°scale
TM	Type of Message	CHAR*4	Codes
AC	Activity	CHAR*3	Codes
ER	End of Record	-	
TS	Trailer Start	CHAR*80	ISO 8859.1
TE	Trailer End	-	
AU	Authenticity Code	HEX*8	Hexadecimal
AG	Agreement	CHAR*4	
SQ	Msg. Sequence No	NUM*3	
TN	Tour Number	NUM*3	
CP	Control Point	CHAR*10	ISO 8859.1
RA	Reporting Area	CHAR*6	ICES/NAFO codes
RC	Radio Call Sign	CHAR*8	
FT	Forward To	CHAR*5	ISO-3/NAFO/NEAFC
TT	Transfer To	CHAR*8	Radio Call
TF	Transfer From	CHAR*8	Radio Call
PO	Port Name	CHAR*20	ISO 8859.1
MA	Master name	CHAR*30	ISO 8859.1
NZ	National Zone	CHAR*3	ISO-3
PL	Platform Number	NUM*9	
PQ	Position Quality	CHAR*1	ARGOS code
CA	Catch Items	CHAR*3 NUM*7	FAO-Codes, 10 pairs
HO	Items in Hold	CHAR*3 NUM*7	----"----
KG	Other Items	CHAR*3 NUM*7	----"----
CG	Count Groups	CHAR*3 NUM*7	----"----
RS	Return Status	CHAR*3	Codes
RE	Return Error Number	NUM*3	Lookup Table
MS	Text String	CHAR*32	ISO 8859.1
DF	Days Fished	NUM*5	
GG	Global Area Grid no	NUM*2	FAO Global Area Grid
GE	Gear	CHAR*3	FAO-Code
VO	Vessel Owner	CHAR*60	ISO 8859.1
VL	Vessel Length	NUM*3	Overall length, meters
VT	Vessel Gross Tonnage	NUM*4	GT 1969 Convention

TYPES OF MESSAGE:

INITIALISATION	MOVE
ENTRY	TRANSFER
EXIT	PORTCALL
CATCH	CONTROL
POSITION	NOTIFICATION

Abbreviation to the first four characters is encouraged.

TYPES OF ACTIVITY:

FIS	= Fishing
NOF	= Not Fishing
PRO	= Production
STM	= Steaming
HAR	= In Harbour

CONTROL POINT:

Typical values from Phonetic Alphabet: ALFA, BRAVO, CHARLIE etc.

RETURN STATUS:

ACK	= Acknowledged
NAK	= Not Acknowledged

FAO GLOBAL AREA GRID:

21	= NAFO Area
27	= NEAFC Area

etc. - Should be specified where misunderstandings are otherwise possible.

SPECIES/QUANTITY COMBINATIONS:

CA (Catch), HO (In Hold), KG (Species Distribution)

Ex: //CA/COD 123 HAD 2345 SAI 56789 HER 98765/

A maximum of 10 pairs of Species and Quantity; where Species are given as FAO code, and Quantities are Round Fresh Weight in kilos. The individual data elements are separated by space.

Only the Field Codes varies between the types of entries.

COUNT-GROUP SPECIFICATION:

Ex: //CG/PRA 13246 GR1 123 GR4 362 GR8 5312 GR6 14/

A maximum of 10 pairs of identifiers and values, where one pair (preferably the first) identifies Species and Total Quantity, and the following 9 or fewer pairs the Group(s) and the Value(s). The individual data elements are separated by space.

EXAMPLES:

Return Message without error specification:

The Norwegian fishing administration NOR returns information to a vessel with Radio Call ABCD that her ENTRy message with sequence number 13, date 961203 and timestamp 12:55 has been ACKnowledged:

//SR//FR/NOR//RC/ABCD//TM/ENTR/RS/ACK//SQ/13//DA/961203//TI/125500//ER//

Return Message with an error specification:

The Norwegian fishing administration NOR returns information to a vessel with Radio Call ABCD that her CATCh message with sequence number 2, date 961203 and timestamp 12:45 has not been acknowledged. The error number is 713 (text found in look-up table):

//SR//FR/NOR//RC/ABCD//TM/CATC//RS/NAK//RE/713//SQ/2//DA/961203//TI/124500//ER//

USER-ASSIGNED ISO-3 CODES

(Ref. ISO 3166; 1993 E/F, Par. 7.3)

XXX	International Waters
XAA	Adjacent Area NOR-RUS
XBS	International Waters Barents Sea
XNS	International Waters Norwegian Sea
XEU	European Union (Waters)
XSV	Svalbard (Fishery Protection Zone)
XJM	Jan Mayen (Fishery Zone)

PREDEFINED ERROR MESSAGES

999	System Error at Other End
800	Your Message has Bad Parity
801	Your Password is Unknown
802	(not used)
803	Your message is Unreadable
804	Unknown Identifier in Message
805	No Message in Your Transmission
890	Pending, Waiting for Duplicate
899	System Error at Other End
700	No Interpretation Possible
701	OK, but No Initialisation
702	OK, but No Entry Message
703	OK, but No Exit Message
704	No Catch Message
705	OK, but Last Message is Missing
706	OK, but Some Messages Missing
707	Message OK, but Other Error
708	Your Message Already Received
710	Unknown Radiocall
711	Unknown Agreement
712	Unknown Area Code
713	Unknown Species
714	Unknown Adm.ISO-3 Code
715	Unknown Checkpoint
716	Unknown Harbour
720	Too many Vessels Active
721	Too many Fishing Days
730	Invalid Area/Agreement combination
790	Data Base Error
799	Contact Receiving Authority

Messages 990-998 are user defined to distinguish between various forms of System Errors.

Annex 4. Management and Administration of the Satellite Tracking Information at the NAFO Headquarters

1. Provisions (Part VI.B.1, Conservation and Enforcement Measures)

Each Contracting Party shall...transmit to the Executive Secretary, on a real time basis, messages of movement between NAFO divisions (as per the requirements of the Hail System outlined in Part III.E of these Measures) for its vessels equipped with satellite devices. The Executive Secretary shall, in turn, transmit such information to Contracting Parties with an inspection vessel or aircraft in the Convention Area.

2. Management, 1996

a) As per the requirements of the Hail System, the NAFO Secretariat is equipped with the following hard/software:

- PC 386, 8 megs of RAM; 125 megs of hard drive
- SVGA monitor, Dos 5.0; windows 3.1 and PROMCOM+
- X-25 connection, 2400 baud
- Data base of MS ACCESS 7.0

This technology has enabled the Secretariat to communicate hail messages between the Secretariat-Ottawa-Brussels on a regular basis.

b) The satellite tracking messages were transmitted to the NAFO Secretariat only from one (1) Contracting Party - Norway. During 1996 there were 283 satellite reports received at the Secretariat. The reports were, in turn, transmitted by fax to two (2) Contracting Parties with inspection presence - Canada and the European Union.

The satellite tracking hails were filed in a separate file but unlike hail reports not computerized due to very different protocol-format (please see Appendix 1).

3. Provisional costs of future satellite tracking programs at the Secretariat

The provisional costs could be projected from the information of the FC Doc. 95/24, first Working Group meeting on this issue.

- The basic annual cost for hard/software would be at the level:

INMARSAT	20,000 USD
EUTELSAT	13,000 USD
ARGOS	10,000 USD

- Service charges would be in the range of 4000-5000 USD.

- Labour costs (upgrade and train one specialist) would be in the range of 3,000-4,000 USD.

4. Conclusion

- There is no provision/decision or agreement made at NAFO for the purpose of management and administration of the Satellite Tracking Program;

- There are several systems available (and extensively used by some Contracting Parties in their waters and elsewhere) which could be deployed for the NAFO Area based on the major idea/principle of compatibility (modulated to the standard protocol-format).

- Consideration should be given to the possibility of unified NAFO system which could combine the hail reports and satellite tracking messages in one harmonious system. In this case, the existing NAFO technology of X-25 connection would be most helpful.

Appendix 1

Hails by Norwegian vessels with satellite devices

TELEFAX

FROM: The Norwegian Directorate of Fisheries Bergen, 96-11-11 16:30
TO: NAFO Executive Secretary

RE: PILOT PROJECT FOR SATELLITE TRACKING (B.1.d)

//SR//FR/NOR//AD/NAFO//RC/JXXJ//XR/M 0003SM/
/NA/INGAR IVERSEN//FS/NOR//TI/154600//DA/961111//TM/MOVE//AC/
//RA///LA/66.451//LO/-030.303//SP///CO///ER//

//SR//FR/NOR//AD/NAFO//RC/JXXJ//XR/M 00033M/
/NA/INGAR IVERSEN//FS/NOR//TI/154800//DA/961111//TM/MOVE//AC/
//RA/3M//LA/47.276//LO/-043.996//SP///CO///ER//

LEGEND

//SR	Start of record
//FR/	From (Contracting Party)
//AD/	To
//RC/	Radio call sign of vessel
//XR/	External number of vessel
//NA/	Name of vessel
//FS/	Country
//TI/	Time
//DA/	Date (yy,mm,dd)
//TM/	Type of report (entry,movement, etc.)
//AC/	Activity (steaming, fishing, etc.)
//RA/	Area
//LA/	Latitude
//LO/	Longitude
//SP/	Speed
//CO/	Course
//ER//	End of record

Annex 5. Icelandic National Report on Satellite Tracking Program and Its Implementation in 1996

As stated in STACTIC Working Paper 96/12, the Ministry for Fisheries acquired a tracking system to fulfil NAFO agreement for automatic position reporting for 35% of its fishing vessels operating in the NAFO area. The Icelandic Coast Guard was appointed to run the system on daily basis on behalf of the Ministry.

Contract was made with the company Marstar in Reykjavik for setting up a fleet tracking system hereafter referred to as **"FTS"**. The system was operational in February 1996.

A maximum of 14 vessels have been tracked at the same time, all via Inmarsat C with communication via Goonhilly in the UK. To gain additional experience from the system, 3 Coast Guard vessels, one Coast Guard patrol aircraft and one Coast Guard helicopter have also been tracked.

All vessels had Inmarsat C previously onboard, so no effort was made to have fishermen purchase communication equipment for this purpose.

Following are specifications for the FTS used:

Specifications for the Marstar Fleet Tracking System: (FTS)

General Description:

FTS uses Inmarsat C for transmission of position data in the current version. It is possible to get position data from other systems into the FTS, both manually, automatically from other FTS systems and from third party systems as specified by the customer.

FTS is divided into the following subsystems:

1. **User interface** which is graphical (GUI).
2. **Relational Database** that stores all data in the system.
3. **Communication subsystem** that receives position data from Inmarsat C or another FTS system.
4. **Event handler** that is responsible for logging all abnormal and selected normal events that occur in the tracking system.
5. **Reports** that can be used to monitor the state and activities in the system.

The users of the FTS are fisheries management personnel that do not have much prior training in computer system operation. The main operation of the FTS does therefore not require advanced skills in computer systems.

General specifications:

FTS version 1.1 will run on Sun-Sparc workstations using the OSF/Motif windowing system. Efforts are made in the design to be able to port a user interface version to MS-Windows. That version will not have any database nor communication subsystem of its own, but rely on a Unix-FTS running on the same network. A full version of FTS is supposed to be offered on Windows NT if it proves to be feasible because of market considerations.

Specific specifications:

User Interface:

The user interface is based on a windowing system. There is one Main window containing a Main menu of the system. All major functions of the system can be performed by selecting items from the main menu, but there are often other methods (short cuts i.e. accelerator keys) that can activate the same operation.

Windows operations: The window operations can be divided into dialogue boxes which are used to input data and i.e. define the active set of vessels under consideration, etc. - and views containing graphical output of the system, i.e. vessel tracks.

Views and layers: A view is composed of different layers in which the graphics are drawn. The user can move and resize a view to show a defined geographic area. More than one view can show the same area (in different scale) at the same time, but if the underlining data changes, all views are updated. Each graphics layer in a view can individually be turned on or off. By having the different features of the maps in FTS on different layers, the user can turn on or off features such as coastlines, depth contours, text. etc.

Size and scale of data in views. The size of a view on the screen can be changed by resizing its window with standard window - system operations.

The scale of the data can be changed in three different ways:

1. **Zoom in operation**, which changes the scale of the map by a fixed factor (default 2,5) and centres about the point where the mouse was clicked.
2. **Zoom out operation**, which changes the scale of the map by a fixed factor (default 2,5) and centres about the point where the mouse was clicked.
3. **Window area operations**, where the user specifies two opposite corner points of an area and then clicks the mouse in the view where this area is to be shown.

Centering: A view can be centred around a point with the Window centre operation, where the user clicks on the point to be centred about.

Vessel selection and display. The user can select vessels to display by the following criteria:

1. **Vessel name** or any part of it.
2. **Inmarsat-C mobile-ID**. A list of ID's can be specified to be included or excluded from the selection.
3. **Vessel group.** A list of groups can be specified to be included or excluded from the selection.

4. **Area.** A list of predefined areas can be specified to be included or excluded from the selection.
5. **Class.** A list of classes can be specified to be included or excluded from the selection. A vessel is always of one class. A class is defined by the user and can be e.g. research vessel, fishing vessel or patrol boat.
6. **Flag.** A list of flags can be specified to be included or excluded from the selection. Each vessel always belongs to a state or country which is called its Flag state or simply its flag.
7. **Date and time.** A start and end period can be specified for the vessel track data, down to a minute or the last position can be seleted.

All the above data items can be selected independent of each other, so the user can i.e. select all ships in an area and not in a specific class for the given period. The user can also choose if he wants the selected tracks to be added to any previous tracks displayed or if older tracks should be erased before the new ones are displayed.

Area operations. Areas can be used to select the data to be displayed as described above. The system can also be used to define an area and display areas.

The user can define up to 100 areas in the system. An area is defined as the co-ordinates of the points defining any polygon. The user can either input the co-ordinates via dialogue box or pick any point from a graphical view.

Poll control. Each vessel has defined a poll period i.e. the interval between automatic position transmissions. The poll period can be changed for individual vessel or the set of vessels currently defined in the graphical selection as described in *"Vessel Selection and Display"* above.

An immediate poll request can be sent at any time to an individual vessel or the set of vessels currently defined in the graphical selection as described in section *"Vessel Selection and Display"* above. If vessel do not respond to the poll an event is generated in the system as described in section "*Event Handler*".

Message transmission. The user can compose a message and transmit it to an individual vessel or the currently defined vessels.

Co-ordinate operations. The following co-ordinate-related operations can be performed by the user.

Point co-ordinates. The system will tell the latitude and longitude of a point selected by a mouse-click.

Distance measurement. The system can show the distance in kilometres between two points defined by the user with mouse-clicks.

Track operations. The user can click with the mouse on a track for a vessel. Then he gets a dialogue showing all data for the vessel. He can then select to look at all current position data for that vessel in a separate dialogue.

Graphical hard-copy output. The user can get a hard-copy output of the contents of a graphical view. The output can be either PostScript or Hewlett-Packard's PCL.

Data base

FTS uses version 7 of the relational database management system from Oracle Group. The database can also be accessed by external systems with standard networking software available from Oracle. This includes TCP/IP, X.25 and DECNET connections from PC's, Mac's, Unix machines and DEC-VAX.

Communications

FTS has built in functionality to retrieve Inmarsat-C reports from a LES. The system can concurrently connect to as many LES's in as many ocean regions as the owner prefers. There is one LES in each ocean region that is the primary LES in that ocean region.

The primary LES is used to transmit messages to vessels in that ocean region.

FTS can receive regular messages in the mailbox of the LES. These messages are sent to an e-mail alias called fts-messages.

Various checks are performed on each position that is received by the system. These checks include a test for all areas defined in the system, if speed is below critical speed in a control area, etc.

All this activity is logged to text-files and scripts are provided to aid in diagnosis of their contents. All data reports or messages that fail validity checks are stored away so they are available for diagnosis.

Communication interfaces. FTS can connect to a LES via direct X.25 connection, dial-up X.3/X.28 or even a leased line to the LES.

LES connectivity. FTS can connect to LES's from Hughes (i.e. Perth) and Thrane & Thrane (i.e.Blaavand in Denmark).

Event handler

Version 1.1 of the FTS can log events to the database where the user can list them out. The following events are logged to the database:

1. Vessel entering a control-area.
2. Vessel leaving a control-area.
3. A vessel reporting a power-up or login in an ocean region.
4. A vessel reporting a power-down or logout in an ocean region.
5. A vessel reporting speed below critical-speed in a control-area.
6. A vessel failing to respond to an individual poll.
7. A vessel failing to acknowledge a message transmission in its current ocean region.

A *control-area* is an area that is specified as such in the database. *Critical-speed* is an attribute of an area in the database but has only meaning if the area is a control-area. *Current ocean region* is an attribute of each vessel in the system that is automatically updated each time a position is received by the system.

Reports

The following reports can be generated by the system:

1. **List of vessels** containing all attributes of a given set of vessels. The following parameters can be used to select the set of vessels to be put in the report:

    a. **Vessel name.**
    b. **A specific class of vessels.**
    c. **A specific group of vessels.**
    d. **Vessels from a specific flag state.**

2. **Track data for a specific vessel** containing all position for the vessel in a given time period. All attributes of the position report are printed out including the origin.

3. **Event log report** can be generated for a specific event or all events in a given time period.

Interface specifications

User interface.

The user interface of the system is graphical and is designed to follow common standards i.e. CUA as closely as possible. The user communicates with the system with a combination of menu selections and dialogue boxes.

Hardware

The Sun-computers to be used for the system should be at least of the same performance as SparcStation LX with 32 MB of memory and a 500 MB disk. The system runs on all Sun / Sparc computers with better performance the LX and can therefore be scaled upwards.

A DAT-tape is recommended for backup, archive and update operation.

Software

The Sun-computer must run Solaris 2.3 or later version. It is possible to connect to the Oracle 7 database from other systems with optional connectivity software from Oracle.

Communications

The system can connect to a LES via X.25 synchronous or via X.3/X.28 asynchronous PAD connection at up to 56 kbit/sec.

Performance specifications

The FTS database can store information for 500 vessels and at least 750,000 position reports at any point in time. The system can also store information about 100 areas and 100 groups of vessels and a map.

The system can handle a map consisting of at least 150,000 vectors.

FTS can handle 250 vessel-reports/hour. Meaning that it can handle 500 vessels transmitting every other hour or 250 vessels transmitting every hour.

Number of users

A single user can use the system at any point in time on the Sun workstation. It will be possible later to connect up to 7 users to the systems database, up to 4 concurrently.

Security

The solaris operating system on the workstation can be set up such that passwords expire automatically and nobody can gain access to the workstation. The X-windows system can also be set up to require a password after a time-out.

Cost associated with implementation of satellite tracking: (in US dollars)

System cost:

Main system:	71.000
Maintenance:	23.700

Cost with the main system includes rent of the following:

2 ea. SUN SPARCstations/Solaris Unix
2 ea. Oracle SQL Run time Licence for SUN
2 ea. Intergraph Microstation for SUN
2 ea. Marstar Fleet Tracking System user licences

Included in the maintenance cost is a routine maintenance of the FTS and cost for some special requirements made by the Coast Guard, such as change of the format of printed data, notification of loss of reports from individual vessels and selection of automatic/ manual polling. Some expenses are also associated with initiation of individual vessels, that is to say download of DNID and programming of report interval, but that is though very limited as this was usually done direct by the Coast Guard. Included is also establishment of a fixed computer connection between the Coast Guard and the Directorate of Fishery.

Communication cost:

All tracked vessels report via Inmarsat C through Goonhilly LES in the UK.

The basic cost for position report is: 0,05 GBP for just the position, but 0,10 GBP if speed and heading is included.

As the FTS is configured to call the LES via X.25 every 30 minutes to extract the reports from a mail box there is an additional X.25 communication cost, which has proved to be nearly the same as the satellite communication cost. It should be noted that for immediate delivery to PSTN or PSDN address, there is no additional cost.

On average, since some vessels send speed and heading with the position and others do not, the cost per report has been about 0,10 GBP (15 US cents).

Result: (Extract from STACTIC Working Paper 96/12).

Some difficulties have been experienced in receiving the reports. The main cause for not receiving the reports have been:

1. When the satcom transceivers are connected to a PC that is also used for other purposes, some softwares, such as Windows Excel are blocking the transceiver. Possible cause is that the programs are writing to the same serial port as the transceiver is connected to and therefore the automatic reports are halted.
2. If the transceiver is occupied in other communication for the vessel at the pre-set reporting time, no position reports are transmitted.
3. A time-out report is issued by the FTS if the connection time to the LES exceeds the pre-set limit, and the connection is broken.
4. Since the system is currently using a dial up X.25 connection, a busy signal is sometimes received from the telephone system.
5. Some of the older Inmarsat transceivers have lost their DNID download data without any obvious cause. One case was that the download data became corrupted in the transceiver and it was not possible to rectify it, even though a new download was transmitted to the vessel repeatedly.
6. If vessels switch between Ocean regions momentarily, and then back again to the one they have the DNID download for, the transmission has to be manually started again. This problem disappears if a download has been done for both ocean regions.

Additional Trials in Iceland:

Additional systems have recently been taken on trial. This includes new reporting system as well as new tracking system.

New Reporting System:

Since January '97 two of the Icelandic Coast Guard vessels have been carrying "Boat Track" reporting and communication system. The purpose of the trial is to gain knowledge of the distribution of the Boat Track signal around Iceland. The trial is of too short a period yet to make any conclusion of its performance. This trial is supposed to last for the period of six months.

New Tracking Systems:

Together with the Boat Track reporting system is a tracking system from Boat Track which runs on PC's under Windows or Windows NT. The system is using dial up communication to extract position data.

Another new tracking system has also been taken on a six month trial. This is an Icelandic system which originally was aimed to fulfil requirements for automatic position reporting system for safety purposes, but has since been modified to receive and display radar data and is used as such at the Air Traffic Control centre in Reykjavik. The Coast Guard is using is to display Inmarsat C position reports from its own vehicles.

Annex 6. NAFO Satellite Tracking Program - Implementation in Canada during 1996

1. Canadian Coverage

1.1 NAFO Regulatory Area - Coverage in 1996

In 1996 there were 9 Canadian vessels which spent a total of 171 days in the NAFO Regulatory Area. Under the pilot project Contracting Parties with 300 days or more of effort in the NAFO Regulatory Area are required to install satellite tracking devices on 35% of its vessels. Even though Canada had less than 300 days of effort in the NAFO Regulatory Area, we did however install satellite tracking systems on 3 vessels which had anticipated fishing in the NAFO Regulatory Area. However, these vessels chose instead to pursue fisheries in Canadian fishing waters.

Of the 9 vessels which spent time in the NAFO Regulatory Area, 6 were northern shrimp vessels. These went to the NAFO Regulatory Area early in 1996 after environmental conditions forced them out of more northerly Canadian fishing waters. Some vessels went directly from northern shrimp to 3M without coming to port. There was not sufficient time to install the systems on these vessels. These vessels did not return to the NAFO Regulatory Area for the remainder of 1996.

As a result, none of the time spent in the NAFO Regulatory Area by Canadian vessels in 1996 was covered by satellite tracking.

1.2 Extent of Canadian Coverage Generally

Since June of 1995, Stratos Mobile Networks (formerly NewEast Wireless Telecom) has been providing vessel tracking and messaging services for the Department of Fisheries and Oceans through the REMS (Remote Electronic Monitoring System) project. This project includes all aspects of installation, commissioning, on-going maintenance, configuration, customer support and training.

A total of 31 complete vessel installations are involved in the project. Sixteen installations were utilized onboard chartered fishing vessels on the Canadian West coast during 1995 and 1996. This portion of the project is now completed. Of the remaining 15 installations, 7 were used on vessels off Newfoundland's East coast, with the remaining 8 currently being installed to accommodate trials in the Bay of Fundy area. These vessels will report their positions to a central fleet tracking centre designated by the Department of Fisheries and Oceans, as well as to any number of other locations defined by the Department of Fisheries and Oceans or vessel owners.

2. Equipment

The mobile equipment is a combination Inmarsat-C transceiver and GPS receiver. It is a small, lightweight electronic unit with a separate antenna referred to as either a Mobile Earth Station (MES) or a Ship Earth Station (SES). The Inmarsat-C system is a low speed Store-and-Forward data communications system. This means that the transmissions to and from an MES are stored in and forwarded by the LES (Land Earth Station).

The vessel can send and receive messages (either, a formatted message that DFO requires for NAFO, a free-form message or a position message) as required.

Inmarsat-C:

Inmarsat-C is a global data communications system developed by the Inmarsat (International Maritime Satellite Organization). Inmarsat owns four satellites that cover the four major ocean regions:

- Atlantic Ocean Region East (AOR-E)
- Atlantic Ocean Region West (AOR-W)
- Indian Ocean Region (IOR)
- Pacific Ocean Region (POR)

The system consists of three major components the Mobile Earth Station (MES), Land Earth Station (LES) and the Virtual Earth Station (VES).

- MES

  The MES is the Mobile Earth Station, which is the unit which is installed on the Ship. This includes the Inmarsat communications and the GPS system.

- LES

  The LES is a Land Earth Station, which are the units that communicate with the Inmarsat satellites. There are 29 LESs located around the world, each communicating with 1 or more of the 4 geostationary Inmarsat satellites that cover the 4 ocean regions.

- VES

  The VES is a Virtual Earth Station, which is a store-and-forward data switch, that is able to connect to any of the 29 LESs. The VES has terrestrial links via a number of network connections.

The Inmarsat-C system is a low speed store and forward data communications link. This means that a shore-to-ship (or in the other direction) message would be received and acknowledged received in the LES before the transmission to the MES would take place.

The Inmarsat-C network is a digitally encoded, L-band system with a sophisticated satellite protocol. It ensures a high degree of data security and integrity.

GPS/Inmarsat integration (Galaxy Inmarsat-C System):

The GPS positioning capability is a part of an integrated system whereby the worldwide communications ability is combined with the precise navigation capability of the Global Positioning System (GPS) in a single integrated package.

The GPS component can provide access to as many as 8 GPS satellites for accurate positioning and the Inmarsat satellites and the Land Earth Stations (LESs) to provide communications. The system can be set to send a position record on timed intervals or can be polled at any time to provide a position report on demand. The Mobile Earth

Stations (MESs) can be polled by a user from shore to change the interval that the MES is using to send its position records. So when there is a problem the system can be polled to give updated positions and smaller interval positioning. There is also a distress alert capability.

3. Types of Information

Under the NAFO Conservation and Enforcement Measures vessels fishing or intending to fish in the NRA are required to hail the position, date, time and catch on board when they Entry/Exit the NRA. They are also required to send messages when they move between NAFO divisions. This system is capable of sending various types of data. Broadly, these can be stated as follows:

- Hail Reports - Where the captain can fill in information on a form and have the information sent (Entry Message).
- Positional Data - These can be sent at particular intervals without interaction from the operator. The system can also be polled at sea and the interval changed or to give a position when queried.
- Freeform Messages - There is a place where the operator can type a message in ASCII format and send it by Internet e-mail, fax, telex, or to an electronic mailbox.

4. Transmission of Data

Vessel position information is automatically transmitted at 6 hour intervals (4 per day) to the Stratos data switch at St. John's, where the information is disseminated to several locations including the Department of Fisheries and Oceans CFIN database, as well as individual fishermen's locales. The information is sent via the Internet or retrieved via dial up using Stratos' shore-side software PC-Access. The Stratos data switch (VES, or Virtual Earth Station) has the ability to disseminate the same information, or portions thereof, to any number of locations worldwide by fax, Internet or to an electronic mailbox for dial up retrieval. The VES is also capable of setting or changing the position reporting intervals of each individual vessel.

5. Connection to the Canadian Fisheries Information Network (CFIN)

CFIN is a client-server system which includes an Oracle database which integrates allocations, licenses, surveillance and enforcement data, and catch information. The system is modular and open-ended, able to receive data from multiple sources using TCP/IP etc. Users at the Department of Fisheries and Oceans access CFIN from IBM-compatible 486/586 client PCs running application software written in Centura Corporation's SQL Windows software, and running under Microsoft Windows 3.x or Windows 95. The database is password-protected.

Data received on the Virtual Earth Station (VES) is written to a UNIX file on a computer which can be continually polled from a computer at the Department of Fisheries and Oceans. Retrieved records can then be automatically processed and added to the CFIN database. If errors are detected, records can be held for on-line correction then automatically added to the database. The polling process just referred to was extensively tested in early 1996. The Department of Fisheries and Oceans intends to implement the automated database incorporation and data correction routines in 1997.

6. Reporting Capability

6.1 Hail Compliancy

A Hails Compliancy routine in CFIN evaluates every positional record to determine whether it is justified by a corresponding Hail record. In cases of non-compliance, the system can generate appropriate letters to the Contracting Party and to the NAFO Secretariat.

6.2 Electronic Map Display

Selected positional data is extracted from CFIN and displayed in electronic map form using SPANS GIS and SPANS Map software.

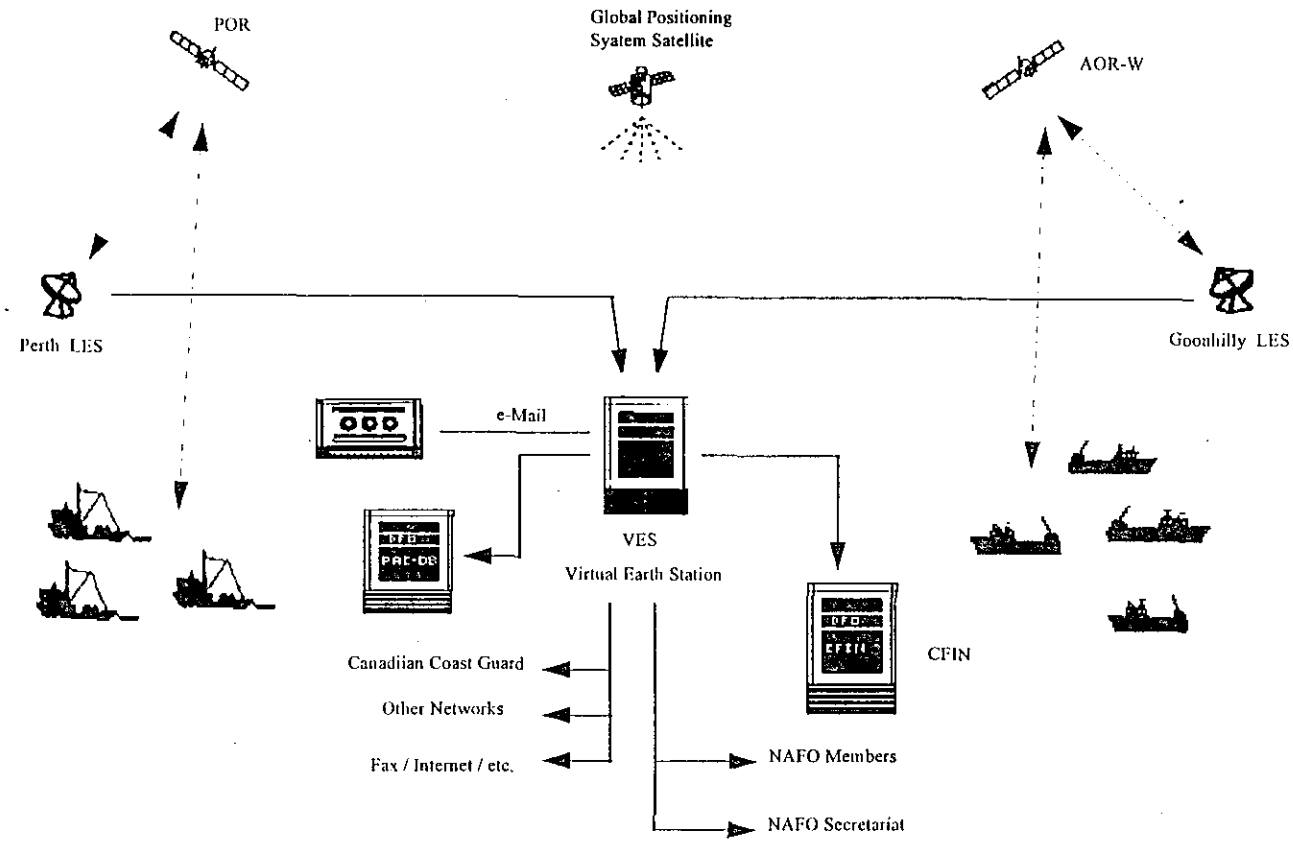
6.3 Ad Hoc Reporting

Ad Hoc reports are generated using the Quest software package from Centura Corporation. Reports cover a range of topics such as last known position of selected vessels, or vessels of selected nations or Contracting Parties; hails received in a specified time period, etc.

7. General Features

Vessel owners have taken advantage of this project also. Since the Department of Fisheries and Oceans has placed the equipment on board at no cost to the vessel owners, they have been given the ability to use the system for only the cost of the actual air time. The unique Stratos billing system allows individual crew accounts and/or shore side accounts to be established so that each user can be billed individually, without the need for the Department of Fisheries and Oceans to reconcile bills for personal messages. The system therefore provides an inexpensive efficient means of private communications for personal messaging as well as market information. The system also allows that vessels receive only their own vessel's position information at their personal computers, thereby protecting each of the owners' location data.

Shipboard users can send to Internet e-mail addresses, fax numbers or other private e-mail boxes. Many vessel owners without access to Internet e-mail have opted for the latter, with free PC-Access software provided by STRATOS, as well as free dial up, via public X.25 dial ports.



Remote Electronic Monitoring System (REMS)

Diagram 1

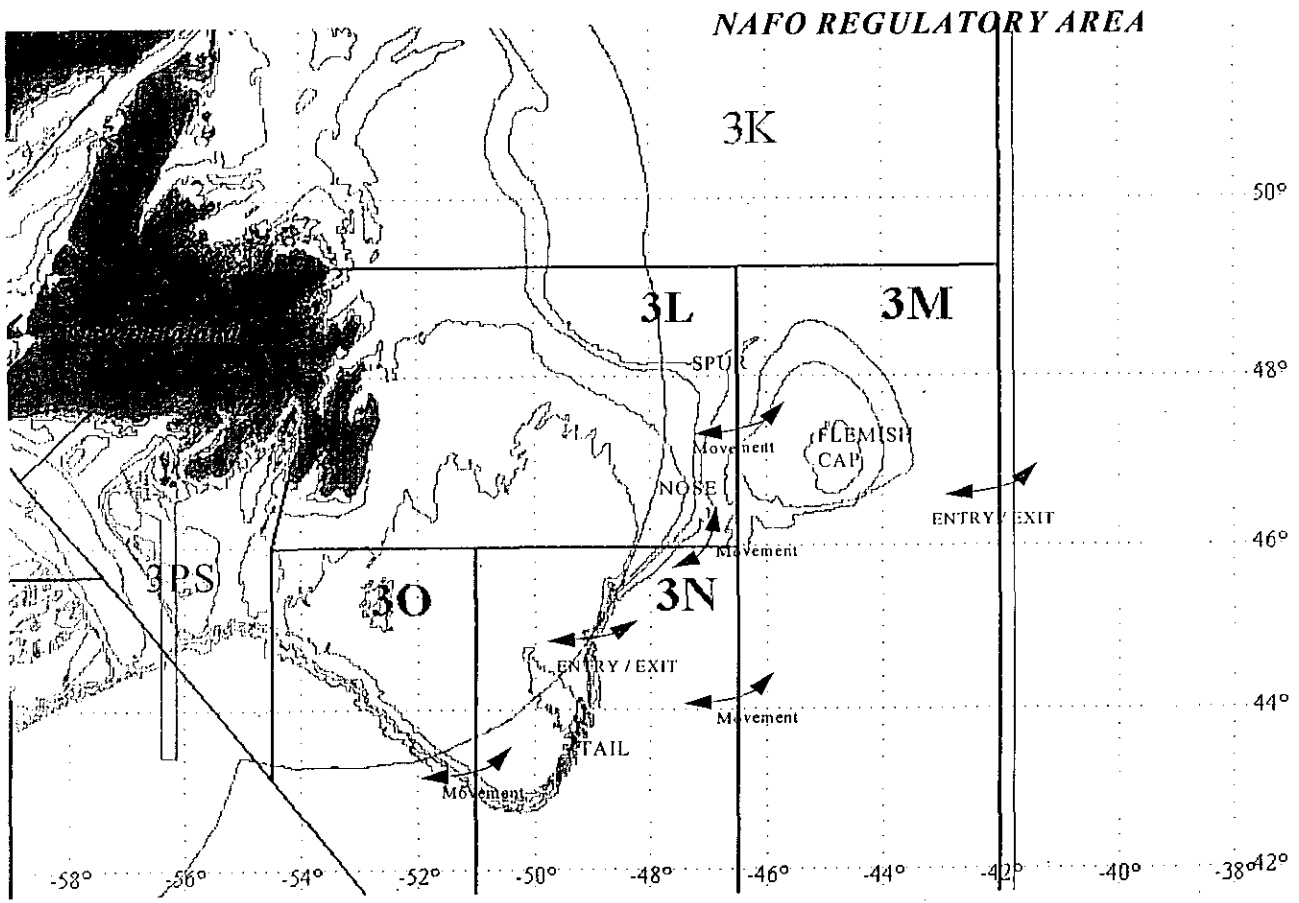


Diagram 2 NAFO REGULATORY AREA - VESSEL HAIL REQUIREMENTS

Annex 7. Approaches of Russia to Improvement of Bioresources Protection, Fishing Regulation and Fleet Surveillance

Development of world fishery, intensity of fishing, growing productivity and fishing fleet capacity are leading to exhaustion of fish stocks and disappearance of some fish species. That predetermined the necessity of searching new approaches to the problems of protection of fish resources, regulation of fishing effort and surveillance of fleet activities.

Fishing is regulated in all regions of Russia by the fishery regulations which take into consideration Russian national interests and mainly satisfy the demands of international conventions and agreements.

The Russian Fisheries Committee has a traditional structure of protection and reproduction of bioresources, regulation of fishing and fleet surveillance.

IT PROVIDES:

1) collection of operative information about the results of fishing effort to the Russian fishing vessels in all areas of the World Ocean on daily basis;

2) monitoring of the state of fish stocks in fishing areas and recommendations on fishing activities;

3) measures for protection and reproduction of fish resources and regulation of fishing;

4) operative inspection of fishing vessels and control of compliance with fishing regulations;

5) surveillance of fleet disposition and shipping safety measures.

The system operation is secured through the fish protection vessels, specific institutions dealing with protection of bioresources (so called Rybvod) and fleet surveillance service.

The Fisheries Committee of the Russian Federation has determined a general strategy in the sphere of fishing management, protection of fish resources and fleet surveillance.

The position of Russia takes into account protection of the national interests of the country as well as the demands of the international conventions and agreements.

The basis of the strategy is the creation of a complex monitoring system of fishing areas.

The main directions of the Russian strategy in the sphere of fishing regulation are:

- perfection of the judicial base,
- development of the organization structure of fish protection service and fleet surveillance,
- equipping the fleet and coastal organizations with modern electronic equipment, means of communication and telecommunication.

To provide continuous control of the vessels activity, the fishing fleet surveillance service has been established.

Protection of fish reserves is conducted by the regional organizations ("Rybvod") in cooperation with the Coast Guard.

The Committee has adopted a decision to create a few regional information centres on the Russian territory for monitoring of fishing.

One of them is the Murmansk centre. It must provide position control of vessels at seas of the European part of Russia. The Far East centre must control fishing at the Bering Sea and the seas of Okhotsk and of Japan.

We conducted with Norway and France joint experiments on using "Argos" and "Inmarsat" satellite systems for position control of vessels at sea.

Following the results of the experiments the Fisheries Committee has adopted a decision to purchase the equipment of the "Argos" regional processing centre and ship transmitters.

With the installation of equipment mentioned, in 1997, the information from the vessels will be received and processed at the Russian centre.

Creation of the regional centres is based on the experience of using traditional information systems and technologies of processing daily reports of the fishing vessels.

Vessel positions are displayed on the electronic map.. When necessary the map scale can be changed.

At user's request the necessary information on any vessel can be obtained; coordinates, catch, state of fish products on board the vessel, etc.

Thus, the Fisheries Committee, its fish protection institutions have a common information network providing collection and analysis of the real catch data.

Positive experience of the cooperation between the Russian Fisheries Committee and the Norwegian Fiskeridirektoratet has been accumulated at the Northern Basin. The information exchange through E-mail about fish landings in foreign ports has been conducted for more than two years. This data has been used to specify catches of vessels at the Barents and the Norwegian seas.

We consider it to be advisable to conclude such agreements with a number of states. That would increase integration of our countries in the sphere of using bioresources.

At present, fishing and fish protection vessels are being equipped with modern means of satellite communication transmitters "Argos" and computing technics.

The onboard program-technical complexes have been developed for fish protection inspectors. The implementation of complexes will enable the inspectors to operatively access the coastal data bases and get the necessary information on a separate vessel during its inspection at sea.

To improve quality and authenticity of the vessel accounts, the software for onboard electronic fishing logs, conosaments and other documentation has been developed.

Special attention has been paid to provide protection of information and its confidentiality. It is planned to conduct field tests of those complexes at the beginning of 1997 at the Barents Sea.

We understand that the rational using of marine bioresources is the problem of international community which requires integration of efforts of all states.

Russia is going to further active work in international organizations and on interstate level in the spheres of fishing regulation, protection and rational using of bioresources on the basis of perfection of international law, international fishing statistics, creation of common information standards, wide usage of modern space technologies and technical decisions, integration into the world information and telecommunication environment.

Annex 8. EU Programmes for Satellite-Based Vessel Monitoring

1. INTRODUCTION

This paper is prepared for the NAFO STACTIC Working Group on the Satellite Tracking Program, NAFO Headquarters, Dartmouth, N.S., Canada, 2-4 April 1997. It provides an overview of recent developments in the European Community with respect to satellite based vessel monitoring systems (VMS) for fishing vessels. In particular, this paper provides some background information on the European Community approach to fishery control and enforcement, as well as a brief description of the current status of VMS, followed by an outline of both Community internal and external programmes in relation to satellite monitoring.

This paper ought to read in conjunction with a preliminary report on the European Community participation on satellite monitoring in the NAFO Regulatory Area.

2. BACKGROUND

Fishing is important to the European Union on two accounts. Firstly, the Community is one of the largest fish producers in the world. Secondly, as a consumer, the Community represents the largest global market for fishery products. The commitment of the Community to the sector has been expressed in the Common Fisheries Policy (CFP) which was formally adopted by the Council in 1983.

In response to internal and external events, the CFP has evolved from a basic policy into a comprehensive and dynamic fisheries regime. It now regulates all aspects of the fishing industry. The policy is comprised of three inter-linked elements made up of, conservation, markets and structural measures. Control and inspection are key components of the CFP which have the ultimate aim of improving compliance with regulations at all stages of the industry from harvesting through to processing and marketing.

Notwithstanding that the rules governing the CFP are adopted at Community level, the main responsibility for ensuring that the rules are applied and enforced rests with the competent inspection and control authorities of each individual Member State. Each Member state must police its own waters and control the activities on its territory.

The organisation of the Monitoring, Control and Surveillance (MCS) services differs from one Member State to another. Some have inspection services dedicated specifically to fisheries activities whilst others call on several different government departments which also perform functions other than fisheries surveillance.

Fisheries control entails big costs for the Member States. The sum of the control budgets of the individual Member States is estimated to ECU 300 million per annum. The Community is helping the Member States by providing financial aid to strengthen their control measures. In the past, Member States have mainly applied for a financial contribution to the purchase of fisheries protection vessels and aircraft. In 1995, the Fisheries Council has adopted a Decision that makes it possible, as from 1996 onwards, to provide additional financial aid to Member States for the introduction of modern technologies for fisheries control.

The European Union has advocated the use of modern technologies for MCS tasks. This approach is evident from the support the European Union has given to the research and development of satellite monitoring as a means to improve the enforcement of the common fisheries policy.

3. EU PROGRAMMES ON SATELLITE MONITORING

(i). EU Pilot projects for satellite monitoring (1994-1995)

In 1992, the Commission proposed the introduction of a continuous position-monitoring system using satellite communications for fishing vessels, in order to improve the effectiveness of surveillance of fishing activities[1].

Subsequently, the Fisheries Council of the European Union decided that Member States were to carry out pilot projects, in cooperation with the Commission, in order to assess the technology to be used and the vessels to be included in the above mentioned system (as provided for by Article 3 of Council Regulation (EEC) No 2847/93 establishing a control system applicable to the common fisheries policy, of 12 October 1993, hereafter called "the Control Regulation"). Commission Regulation (EC) No 897/94 laid down detailed rules for the pilot projects.

Thirteen EU Member States (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, the Netherlands, Portugal, Finland, Sweden and the United Kingdom) have carried out pilot projects for satellite monitoring, involving up to 350 vessels throughout the Community.

Three different, commercially available, satellite-based vessel monitoring systems were used to track the movements of the participating vessels. Several Member States tested more than one of these systems. All Member States evaluated the potential of GPS-INMARSAT, Some Member States also tested ARGOS and/or EUTELTRACS. In a complementary project, Greece researched and tested a monitoring system which depended on VHF/DSC data communication as opposed to relying upon a satellite communication system. The United Kingdom also conducted trials with Automatic Position Recorders (APR), which store data onboard the vessel without transmitting information in real-time.

The way in which the pilot projects were set up is an illustration of the close co-operation between EU Member States to overcome technical and practical difficulties. Each Member State operated through a Fisheries Monitoring Centre (FMC), which was able to determine the position of its fishing vessels included in the pilot project, wherever they operate. The data from each vessel were always directed to the FMC of its Flag State. If the vessel's position was in the waters under the jurisdiction of another Member State, the Flag State FMC re-transmitted the position data to the Coastal State concerned. By this procedure each Member State received position information relating to all vessels included in the pilot project and located in waters under its jurisdiction or sovereignty.

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[1] COM(92) 392 final.

The Scandinavian countries set up a regional model for data exchange. Denmark, Finland and Sweden operated a joint project, in which common hard- and software were installed in Copenhagen, Denmark.

The pilot projects were funded with ECU 10 million from the Community budget. The projects started in July 1994 and ended in December 1995. After the pilot project a number of Member States continued to use the systems as a means of improving and developing their understanding of this type of technology for fisheries enforcement and conservation purposes.

The pilot projects were coordinated by the European Commission. The Commission regularly organised meetings of the Expert Group Fisheries Control with the national officials in charge in the Member States in order to facilitate cooperation and to monitor the progress of the projects.

(ii). Evaluation of the pilot projects

The pilot projects proved the reliability of real-time satellite position monitoring and established that this type of technology will greatly enhance the efficiency and effectiveness of the existing aerial, surface and land based control resources.

Although the pilot projects in the Member States revealed a number of technical problems it also clearly demonstrates that these could be resolved by a joint approach between the project managers and the system providers. It was particularly evident that satellite based vessel monitoring technology has evolved considerably during the period of the project.

This trend is set to continue. The further development of ready-to-use products as well as the improvement in satellite services will greatly assist the realisation of the full potential of an operational system.

(iii). The utility of VMS

VMS provides information. This information may be limited to obtaining the position of a fishing vessels at a particular time and date. VMS provides the user, however, with this information at frequent time intervals. These intervals may vary. In some instances it may be appropriate to have position reports every ten minutes on the one hand, whereas in other instances it may be more appropriate to have daily position reports. Information derived from the VMS may also include the course and speed of a vessel. This information may be determined from the data stored on board the memory of equipment fitted on board the fishing vessel (the blue box) which is transmitted to the monitoring centre. Or in alternative, the monitoring centre may be able to extrapolate from several position reports received from a vessel the course and speed of the said vessel.

With VMS data it is possible to deduce the activity of vessels. For example, a series of consecutive positions at a speed in the range of 4-6 knots from a trawler may indicate that the vessel is towing gear. Precise position patterns of the activity of vessels will of course depend on the type of fishing vessel and the fishing activity pursued. Thus for example, the position, course and speed patterns of a long-line vessel will differ significantly from vessels engaged in other types of fishing.

VMS, if certain systems are relied upon, may also allow for the transmission of catch and effort data, and the benefits to be derived from this information are obvious for any management system which relies upon accurate catch and effort data to manage fisheries on a sustainable basis. VMS may also be designed to allow the transmission of advance notification prior to arrival or departure of a vessel in and from a port. This type of application is also of particular benefit in relation to monitoring fishing effort zones or in the case of sensitive or restricted fishing areas.

Indeed the utility of VMS continues to evolve and there may be further developments in the near future regarding the expansion of other applications such as an inter-face with an electronic logbook or the linking of VMS with vessel sensors placed in trawl winches which will allow the enforcement authorities to monitor the vessel more thoroughly.

VMS will not replace conventional enforcement tools such as patrol vessels and aircraft, it will nevertheless improve the efficiency and effectiveness of their deployment. Finally it ought to be pointed out that the probity and admissibility of the evidence derived from VMS will depend on the rules of evidence in the Member State in question.

(iv). Proposal for an operational Vessel Monitoring System (VMS)

In May 1996, the Commission presented a report on the pilot projects and a proposal for the introduction of an operational VMS to the Fisheries Council of the European Union[2].

The European Parliament supports the Commission proposal to introduce a VMS for Community fishing vessels[3]. The Parliament is also in favour of financial participation by the European Union in the setting up of this system. The Parliamentary report on VMS stresses the importance of the system being applied fairly in all Member States and the importance of not imposing excessive administrative burden on fishermen.

In December 1996 after considerable debate the Council reached a political agreement to introduce an operational system to monitor the activities of fishing vessels by satellite.

(v). Political Agreement

The VMS will be introduced in two phases.

In the first phase, which commences on the 30 June 1998, vessels exceeding 20 meters between perpendiculars (24 metres overall) in the following categories are required to be equipped:

- vessels operating in the high seas, except in the Mediterranean Sea,
- vessels operating in the waters of third countries, provided provisions have been made in Agreements with the relevant third country or countries for the application of a VMS to the vessels of such a country or countries operating in the waters of the Community,
- vessels catching fish for reduction to meal and oil.

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[2] COM(96) 232 final, 96/0140(cns).

[3] Opinion delivered on 13 December 1996 (not yet published in the Official Journal).

In the second phase, which commences on the 1 January 2000, all vessels exceeding 20 meters between perpendiculars (24 metres overall) are included in the system. There is, however, an exception for vessels operating exclusively within 12 nautical miles of the baselines of the flag Member State, and for vessels which operate at sea for less than 24 hours. The satellite-based vessel monitoring system shall apply to Community fishing vessels operating in third country waters only in the case where the third country or countries in question have accepted the obligation to apply a satellite-based vessel monitoring system to their vessels operating in the waters of the Community.

The devices fitted on board the fishing vessels shall enable the vessel to communicate its geographical position to the flag State and to the coastal Member State simultaneously.

An obligation is placed on Member States to establish and operate Fisheries Monitoring Centres which will be equipped with the appropriate staff and resources to enable Member States to monitor the vessels flying their flag as well as the applicable vessels flying the flag of other Member States and third countries operating in the waters under the sovereignty or jurisdiction of the said Member State.

The political agreement on VMS is being adopted in the form of a Council Regulation and further detailed rules for the implementation of the system will be adopted by the European Commission taking into account the opinion of the Management Committee for Fisheries and Aquaculture.

(vi). The cost/benefit of the VMS

The cost of the VMS will depend on the number of participating vessels and on the system(s) selected by the Member States. E.g. the annual cost of monitoring a fleet of 4,000 vessels is likely to be of the order of 8 Mecu. It ought to be pointed out, however, that costs may be substantially reduced if Member States and fishermen work together to choose the least expensive system that achieves the control and surveillance objectives.

The benefits from VMS will be derived from its utility and effectiveness as an enforcement tool to address the shortcomings in the enforcement of the CFP.

Firstly, VMS is the only control means that provides continuous information on the location of fishing vessels. This allows Member States to monitor directly the compliance with all provisions related to geographical restrictions, in particular closed areas and tie-up rules. In this respect all other control methods are more costly and less efficient for this purpose.

Benefits from satellite technology will further be achieved through the *synergy* with the conventional control means, in particular the improvement of the aerial and marine surveillance. Information provided by the VMS will improve the deployment of aircraft and patrol vessels. Less time will be spent with searching the fishing vessels, more time will be devoted to inspection. VMS may enable both aircraft flying hours and vessel sailing time to be reduced, hereby reducing the operational costs. An increase of 20% in the effectiveness of marine surveillance, which has an estimated annual cost of 100 MECU, is not unrealistic and already justifies the introduction of a VMS.

Furthermore, the shore-based inspectorate will benefit from the information provided by VMS. Its efficiency will be increased, since VMS will alert the inspectorate to possible illegal or unauthorised landings and transhipment, which have been traditionally very difficult to combat using conventional enforcement tools. VMS also offers valuable information with which the data in logbooks may be verified including the cross-checking of the catch area against positions recorded in the logbook. Further scope for improving control measures is provided by the facility introduced by VMS to collect more comprehensive statistics on fishing activity. Improved management information in turn enables the fishing activities to be better monitored.

Satellite monitoring also has a deterrent effect. Fishermen will be less inclined to mis-report their position and their activity, as they will be aware that the authorities are continuously monitoring their position. This form of preventive enforcement is very beneficial, it is however difficult to quantify. Its advantage over the deterrent effect of the traditional control means lays in its continuity and in its global geographical coverage.

The use of VMS and the exploitation of its communications features in real time would offer scope for much better coordination and greater *transparency* between the appropriate authorities. This would ensure equal treatment for all fishing vessels. This advantage is an essential one, but again cannot be quantified.

4. EXTERNAL PROGRAMMES ON SATELLITE MONITORING

(i). NAFO Pilot Project for Satellite Tracking (1996-1997)

The EU is involved in the pilot project for satellite tracking of the Northwest Atlantic Fisheries Organisation, see attached preliminary report for further details.

(ii). Fisheries agreement between the Kingdom of Morocco and the EU

In 1995, the European Union and Morocco concluded a four-year fisheries agreement that allows mainly Spanish fishing vessels to fish in Moroccan waters.

This agreement strengthens fisheries controls and includes a pilot project for satellite monitoring. Vessel tracking in the Moroccan fisheries zone will allow direct control of the provisions concerning fishing effort and geographical restrictions.

Morocco and the EU have set up a working party to lay down detailed arrangements for this pilot project. It is expected to be operational later this year.

(iii). Fisheries agreement between the Islamic Republic of Mauritania and the EU

In 1996 the EU and Mauritania concluded an Agreement in the sea fisheries sector. The Agreement stipulates that pending the implementation of a national satellite monitoring system for fishing vessels of similiar type operating in Mauritania's fishing zone, both Parties agree to implement a bilateral satellite tracking project for Community vessels. Vessel tracking in the Mauritanian fisheries zone will allow a direct control of the provisions concerning fishing effort and geographical restrictions. Furthermore, it will allow for targeting inspections at sea and retrospective controls of the zones declared in the fishing logbook.

The Parties will set up a working group to define the procedures for setting up, implementing and financing the project.

5. DG XIV TRIALS (since 1992)

The Directorate General for Fisheries (DG XIV) of the European Commission has also been conducting its own trials since 1992. DG XIV is using its inspection vessel operating in the NAFO Regulatory Area for this purpose.

During 1992-1993, several systems have been tested on board the patrol vessel ERNST HÄECKEL: Argos, Euteltracs, Monicap and a GPS/Inmarsat mobile communication terminal (Capsat, from Thrane&Thrane). The respective monitoring software packages were installed at DG XIV's offices in Brussels, Belgium. A prototype for system integration, called MERCURE, was developed. MERCURE ran on a SUN station and was able to integrate data originating from Argos, Eutelsat and Monicap. Monicap as been developed by Portugal with support from the Community and is a tracking system based on GPS/Inmarsat.

In 1994 and 1995, the patrol vessel KOMMANDOR AMALIE was equipped with Argos and GPS-Argos. The Prodat system was tested as well, on board the research vessel BELGICA.

Further trials will be conducted as necessary.

Annex 9. Preliminary Report on the Results of the Pilot Project on Satellite Tracking Implemented by the European Union

1. INTRODUCTION

This document is prepared to describe the EU involvement in the NAFO pilot project for satellite tracking from a technical perspective.

This paper describes Member State participation in the pilot project and the the procedures used to transfer data from Member States' Fisheries Monitoring Centres (FMC) to the European Commission, DG XIV, and from the European Commission to the NAFO Secretariat in the framework of the pilot project for the NAFO regulatory area.

2. LEGAL BASE

The legal base for the establishment of the pilot project:

- NAFO Conservation and Enforcement Measures - Part VI.B.1
- Council Regulation (EC) N° 3070/95 of 21 December 1995 on the establishment of a Pilot Project on satellite tracking in the NAFO Regulatory Area.

3. OVERVIEW

During the period of the pilot project 35 % of the vessels fishing in the NAFO area are required to be equipped with a system able to transmit automatically satellite signals to a land based receiving station (FMC) permitting a continuous tracking of the vessel by the flag Member State. Four EU Member States have actually equipped vessels with satellite tracking devices in order to fish in the NAFO Regulatory Area (NRA)[1]. The systems being used are based on GPS/INMARSAT.

During 1996, one Danish vessel was equiped with GPS/INMARSAT. Fifteen German vessels which comprise the entire deep sea fleet are equipped with VMS, but none of these vessels have operated in the NRA recently. Fourteen Spanish vessels have been equipped with a GPS/INMARSAT system. Sixteen Portuguese vessels held NAFO licences and 7 of these vessels carried the MONICAP "blue boxes". No UK vessel has operated in the NAFO area in 1996.

The position reports from the vessels are transmitted on a real time basis to the flag Member State which is obliged to transmit the corresponding data to the Commission. However, the Member States and the Commission still have some minor technical issues to resolve relating to the transmission of this information.

The onward transmission of information to the NAFO Secretariat will be undertaken through similiar procedures as the ones relied upon in the NAFO hail system automation pilot project, as referred to in the STACTIC Working Paper 97/2 under item 2(a).

The total cost of the project is estimated at 0.5 MECU.

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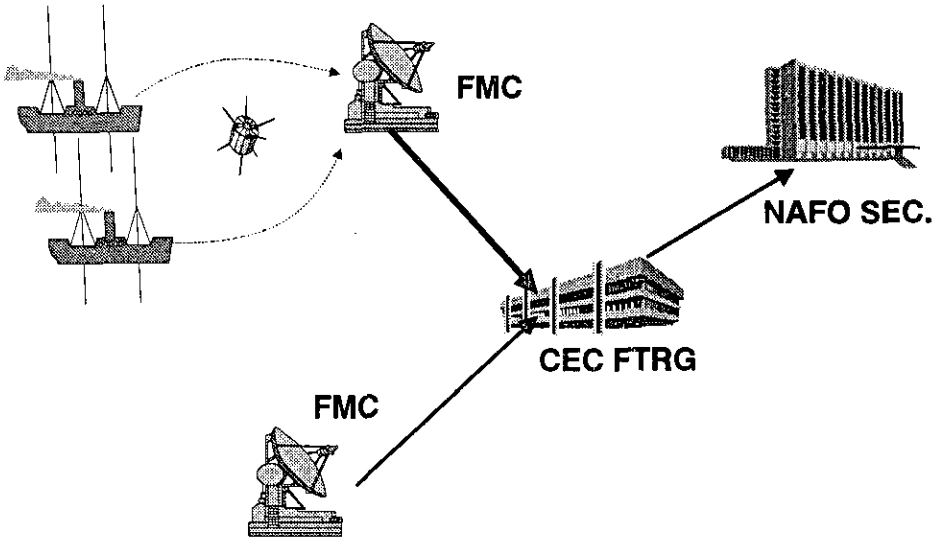
[1] Denmark, Germany, Spain, Portugal. The United Kingdom will participate in 1997 if vessels flying the UK flag operate in the NAFO Regulatory Area.

4. MESSAGE FLOWS

In practice the system should operate as follows. Vessels equipped with satellite monitoring devices and fishing in the NAFO regulatory area communicate position reports on a regular basis to the flag Member State's Fisheries Monitoring Centre (FMC). This information is consolidated into hail reports and where applicable geographical distributions are communicated to the European Commission (Directorate General for Fisheries - DG XIV) collects the incoming messages, maps them to the appropriate data exchange format and forwards these to the NAFO Secretariat.



5. MESSAGES

Under the pilot project three message types are foreseen:

i) hail reports

ii) position reports (transmission from the flag Member State to the European Commission)

iii) geographical distribution

The development of the hail report messages is currently being pursued as a priority given the requirement of onward transmission to the NAFO Secretariat.

It should be kept in mind that the European Commission receives message of movements between NAFO divisions (as per the requirement of the hail system) from the EU Member States concerned. The messages received by the European Commission are batched together and forwarded regularly to the NAFO Secretariat. The format used for the transmission of messages to the NAFO Secretariat is independent of the systems used to track the vessels.

The format used for the purpose of the pilot project may differ from the specification set out in the forthcoming application regulation for the implementation of an operational satellite based VMS for Community fishing vessels exceeding 20 meters between the perpendiculars (24 meters length overall).

6. COMMUNICATION WITH THE EUROPEAN COMMISSION

For the purpose of the pilot project the preferred method of communication with the European Commission is through the File Transfer Gateway facility (FTRG).

The FTRG facility acts as the hub for the transfer of messages between the Member States and the Commission and between the Commission and the NAFO Secretariat. It is situated at the European Commission's Telecommunications Centre in Luxembourg and is accessible via various communication protocols.

7. VESSEL TRACKING SYSTEMS APPLIED BY THE MEMBER STATES

7.1 DENMARK (to be completed)

7.2 GERMANY (to be completed)

7.3 SUMMARY OF SPANISH PILOT PROJECT ON THE NAFO AREA

The Spanish Pilot Project on the NAFO area, is based on the hardware, software and communications infrastructure existing at the Spanish National Center, to which some essential modifications are being incorporated in order to fulfil the requirements demanded by Council Regulation (EEC)N° 3070/95.

The Spanish vessel monitoring system under INMARSAT-C, is embodied in the Control Center of National Fishing Vessels (Madrid), with interchanges data with the Blue Boxes installed on board the fishing vessels through two Coastal Stations (LES), SINTRA (Portugal) and BURUN (Holland). Likewise, the system can be connected to 5 international Terminals, one of which that belonging to the Commission.

The Spanish fishing vessels who participate in this Pilot Project, have been chosen among those authorized to fish in the NAFO Area during the year 1997. It is envisaged to install mobile equipments in 15 of these ships, thus completing the 35 per cent share contemplated in the Council Regulation.

Fourteen of the selected vessels are now equipped with their corresponding Blue Box, eight of which will incorporate the new operative software.

Tests of communication with the Commission, have already been successfully carried out. The process of updating the mobile equipment installed in 1996, is under way, while the installation of the new units in the remaining vessels, is waiting for the arrival of these ships to port.

On the other hand, the Spanish Blue Box, admit different communication systems (multitransceiver), apart from being closed and sealed, detecting any possible manipulation by the crew members, and fulfilling some strict norms of quality.

Among the more important functionalities of the Blue Box, there are the following:

- Capture of position.
- Periodic transmission of positions.
- Detection of transfer of ports, special zones, NAFO divisions and subdivisions.
- Detection of begins/end of fishing operations.
- Reception of messages of the Center of Control.
- Activation of SOS messages.
- Presentation of messages in display.
- Report from anomalies in the blue box.
- Capacity of connection of an external P.C.
- Storage of messages.

The Fisheries Monitoring Center, channels and analyze the whole information of the fishing fleet equipped with Blue Box. The most important functionalities are:

- Graphic Presentation of the stage of pursuit.
- Access to the data of the ships.
- Administration and presentation of the messages sent by ships.
- Administration of the transmission of messages to the ships.
- Creation of special zones and ports.
- Presentation of routes of ships.
- Shipping of messages to C. International.
- Administration of warnings of incidences.
- Generation of Reports and Statistical.

Modifications on Vessel Monitoring System

Between the modifications to be implemented on Vessel Monitoring System, we have the following:

- All the messages originated by the blue box in STORE and FORWARD will be made with verification of delivery in satellite.
- Option of choosing the individual format of shipping of each type of messages to the Center of Control by the operator.
- Automatic Retransmissions to the Commission, of the data of the ships received at the Control Center, endorsed by a fax line in case of wrong operation of the main system.
- Temporary change of coastal station in case of failure of the main one.
- Discrimination of cost of transmissions when there are several addressees.
- Connection of an external P.C.

In summary, Spain is making good way with respect to the communications to the Commission. Similar progress is being made with regard to the installation and modification of the mobile equipment. It is hoped to start sending vessel data to the European Commission Centre in accordance with Council Regulation No. 3070/95 during the second week of April.

ESQUEMA DEL SISTEMA DE MONITORIZACIÓN NAFO

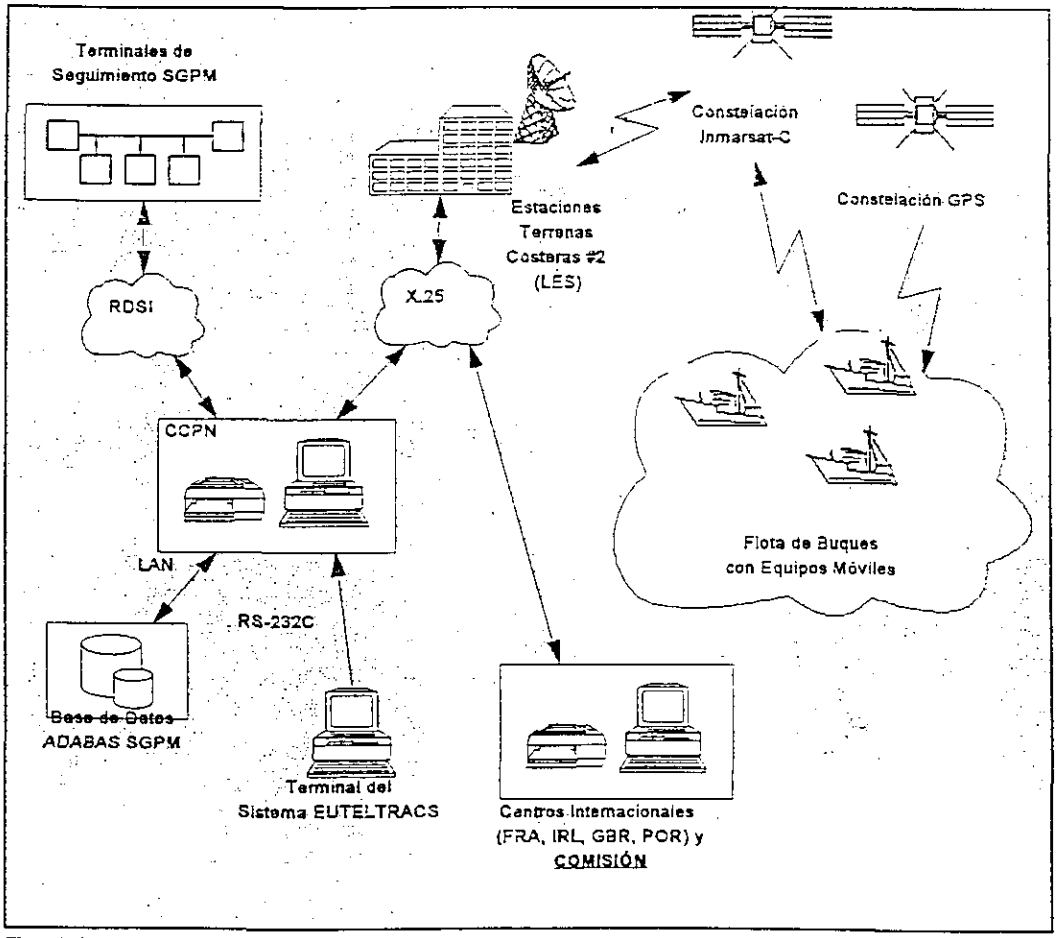
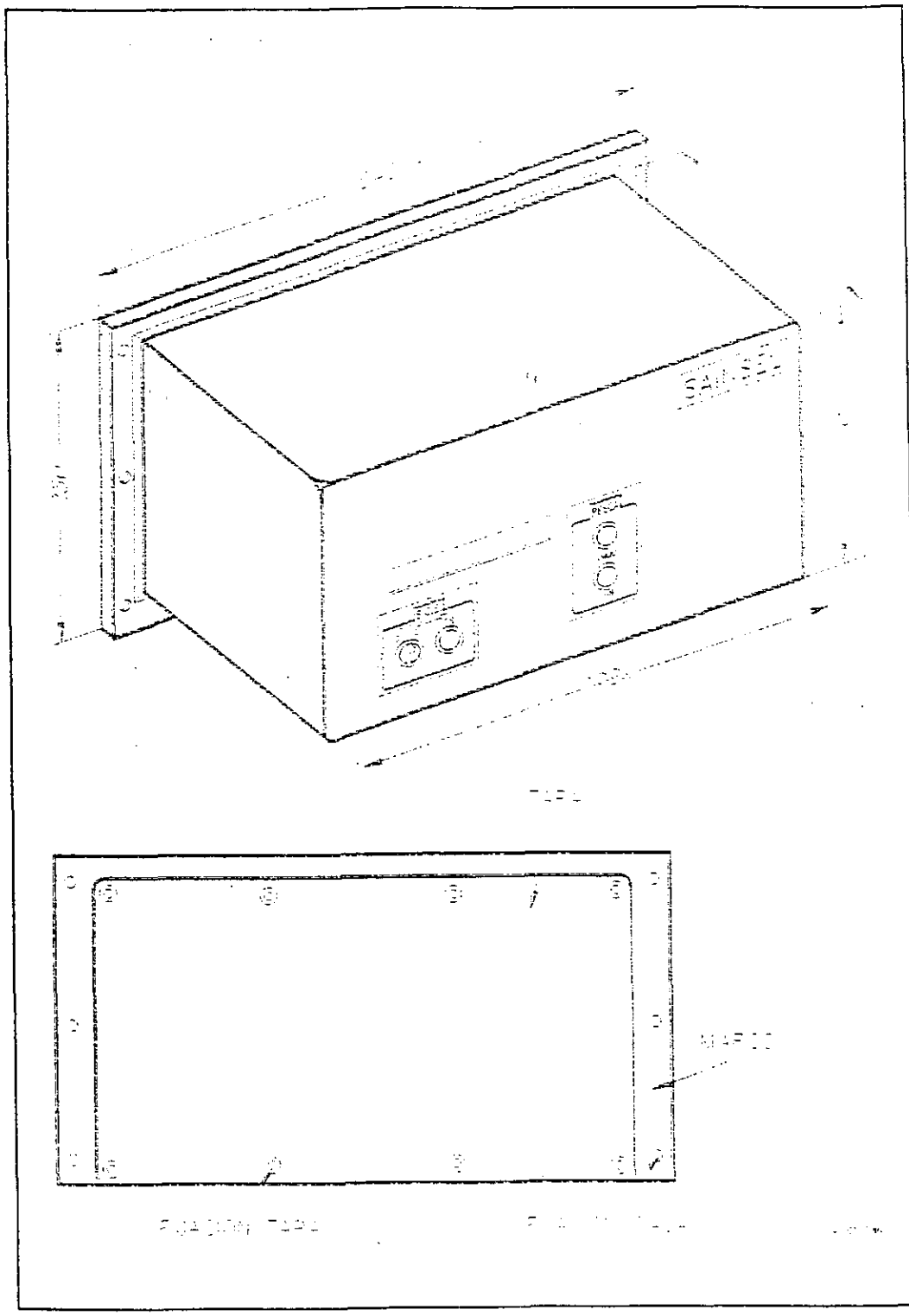


Fig. 1 Diagrama del Sistema MPVS-NAFO



Ilustr. 5 Caja del equipo móvil. Vista exterior.

7.4 SUMMARY OF PORTUGUESE TESTS

STATISTICAL DATA

16 Fishing vessels in the NAFO area
7 Vessels with the Blue Box installed
(2 vessels have the box software with the NAFO divisions)

December/96

	Periodic msg.	Hail msg.	Lost msg.
Vessel 1	94	18	1
Vessel 2	91	12	4 (+ 1 error)

EQUIPMENT COSTS

1 Blue Box _____ 2 000 000 PTE (10 000 ECU)

7 Blue Boxes (Pilot Project)_____ 14 000 000 PTE (70 000 ECU)

16 Blue Boxes (All the vessels) _____ 32 000 000 PTE (160 000 ECU)

SOFTWARE COSTS (Control Centre + Blue Boxes concerning only the NAFO Pilot Project)

_____ 2 200 000 PTE (11 000 ECU)

TRANSMISSION COSTS

- **1 Vessel/1 Month** 90 periodic messages (8H)
  15 hail messages (average value)

  With samples (10 minutes)_____ 30 000 PTE (150 ECU)
  Without samples _____ 8 000 PTE (40 ECU)

- **1 Vessel/1 Year** (Considering that each vessel fishes, on average, 4 months by year in the NAFO area)

  With samples (10 minutes) _____ 120 000 PTE (600 ECU)*
  Without samples _____ 32 000 PTE (160 ECU)*

  *These values don't include the periodic messages when the vessel is not fishing in the NAFO area.

• **7 Vessel/1 year** (Considering the vessels in the Pilot Project)

With samples (10 minutes)_____ 840 000 PTE (4 200 ECU)
Without samples _____ 224 000 PTE (1 120 ECU)

• **16 Vessel/1 year** (Considering all the vessels)

With samples (10 minutes)_____ 1 920 000 PTE (9 600 ECU)
Without samples _____ 512 000 PTE (2 560 ECU)