Mag Fdir

Progress Report

The Norwegian Trials January - July 1996

NAFO Satellite Pilot Project

Fdir-SAT 96:1 Bergen 2. September 1996

FISKERIDIREKTORATET

3d

04v400214

Commissioned by
The Directorate of Fisheries

Commissioning authority's ref.
SAT 96:1

Department
IT Department

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Type of publication
Progress report

Number of publication
Fdir-SAT 96:1

ISSN
ISBN

Title
The Norwegian Trials January - July 1996
NAFO Satellite Pilot Project

Status
Released

Number of pages
22

Version number
1.15E

Date
5. September 1996

Signature

Resume

At their 1995 Annual Meeting, the parties to the Northwest Atlantic Fisheries Organization (NAFO) agreed to carry out a Pilot Project on the use of satellite systems to improve compliance with the conservation measures within the NAFO Regulatory Area during 1996/ 1997. This is a progress report on the trials of the Norwegian party, covering the period from January to July 1996. The report has been produced in time for the 1996 NAFO Annual Meeting.

A total of 23 vessels equipped with satellite tracking units had been commissioned by the Norwegian party by the end of July, of which altogether 15 had by then participated in the fisheries for shrimp at Flemish Cap, within the Regulatory Area.

More than 56 000 position reports have been received so far during the trial by the Directorate of Fisheries. Of these, 25 275 have come from within the NAFO Convention Area, and 1 440 from St. John's/Harbour Grace.

A total of 144 Hails to the NAFO Secretariat have been generated automatically by the Directorate of Fisheries computer system.

Satellite units for the Inmarsat-C, Argos and Euteltracs/Canadian-OmniTRACS systems have been employed by the Norwegian party.

Topic Words
NAFO, Flemish Cap, tracking, satellites, Argos, Inmarsat-C, Euteltracs, OmniTRACS

Distribution

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1. INTRODUCTION

At their 17th annual meeting in September 1995, the contracting parties to the Northwest Atlantic Fisheries Organization (NAFO), in order to improve compliance with their Conservation and Enforcement Measures, agreed to implement a Pilot Project for Satellite Tracking of fishing vessels (NAFO/FC Doc. 95/17). According to this agreement, the parties undertook to install satellite tracking devices on 35% of their respective vessels fishing in the NAFO Regulatory Area during the period from 1 January 1996 to 31 December 1997.

Further, each party shall endeavour to test several systems of satellite tracking, and install at least one receiving station associated with their satellite tracking system. Contracting parties shall transmit to the NAFO Executive Secretary messages of movement between NAFO divisions on a real time basis, for their vessels so equipped.

Each party shall prepare a report on the results of the Pilot Project, to be submitted for consideration at the September 1997 Annual Meeting of NAFO.

This paper is a progress report from the Norwegian party, covering our activities from January up to and including July 1996.

2. THE TRIALS

2.1 Equipment on board vessels

Based on the agreed criteria, Norway has been in a position to allow 32 of her vessels to fish for shrimps at Flemish Cap in the NAFO subdivision 3M for a total of 2 206 fishing days in 1996. The actual number of vessels which would eventually take up the option to participate in this fishery was not established by the time the national regulations for 1996 were drafted. It was therefore decided that all Norwegian vessels taking part in the Flemish Cap shrimp fisheries for 1996 should carry satellite tracking devices.

The report from the STATIC Working Group Meeting on the Pilot Satellite Project (NAFO/FC Doc. 95/24, October 1995), identified three providers of satellite tracking systems which could be used in the NAFO Regulatory Area, i.e. CLS/Argos, Eutelsat and Inmarsat.

ARGOS could provide the Mar-GI/GE systems with GPS capability, as well as the traditional Mar-90 system.

EUTELSAT could provide the Euteltracs system with North East Atlantic coverage, as well as a possible link to the Canadian-OmniTRACS system for NAFO area coverage.

INMARSAT could provide tracking through the Inmarsat-C system via the West Atlantic (AOR-W) satellite.

Of the 32 relevant Norwegian fishing vessels, 16 were found to have Inmarsat-C equipment already installed by the end of 1995. This equipment was, however, acquired for reasons other than tracking, and a fair amount of testing would therefore be necessary to ascertain that tracking would work satisfactory. It was decided that a subsidy of NOK 20 000 ($ 3 000) should be provided by the Directorate of Fisheries for vessels buying their own tracking devices specifically to participate in the Flemish Cap fisheries. If the ship owner was not interested in buying such equipment, suitable tracking devices would be provided by the Directorate of Fisheries at no cost to the vessel, for the duration of the trials.

At the end of July 1996 six ship owners had taken up the option to buy Inmarsat-C units for the NAFO trials. 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.

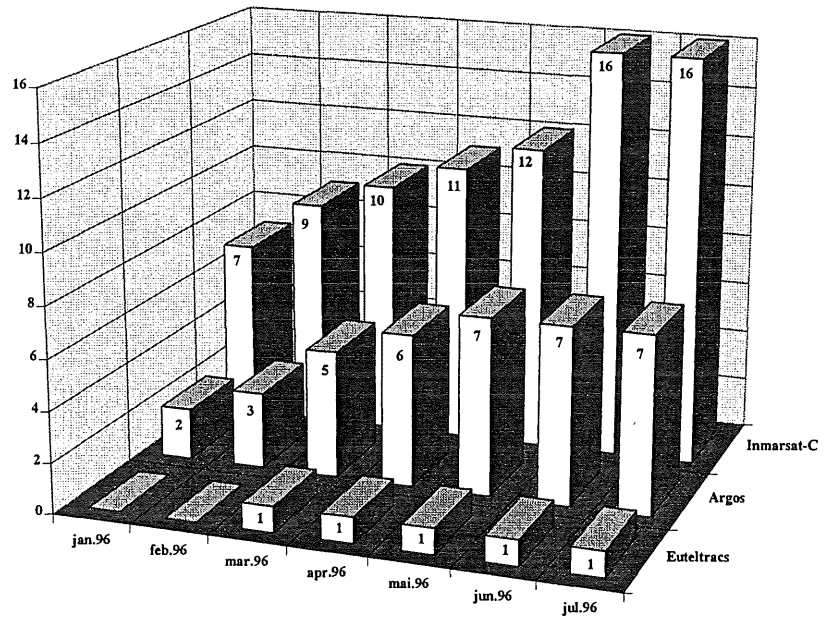

Figure 1) Tracking units commissioned by type and month

Figure 1 shows the accumulated commissioning of tracking equipment by type and month. It has been a requirement that the equipment shall be operational

before a vessel can sail for the NAFO area. Figure 2 shows actual participation in the Flemish Cap fisheries by month, as compared to the number of vessels commissioned. It can be seen from the graph that the number of Norwegian vessels active in the NAFO area was 12 by the end of July 1996, as compared to a total of 23 vessels commissioned.

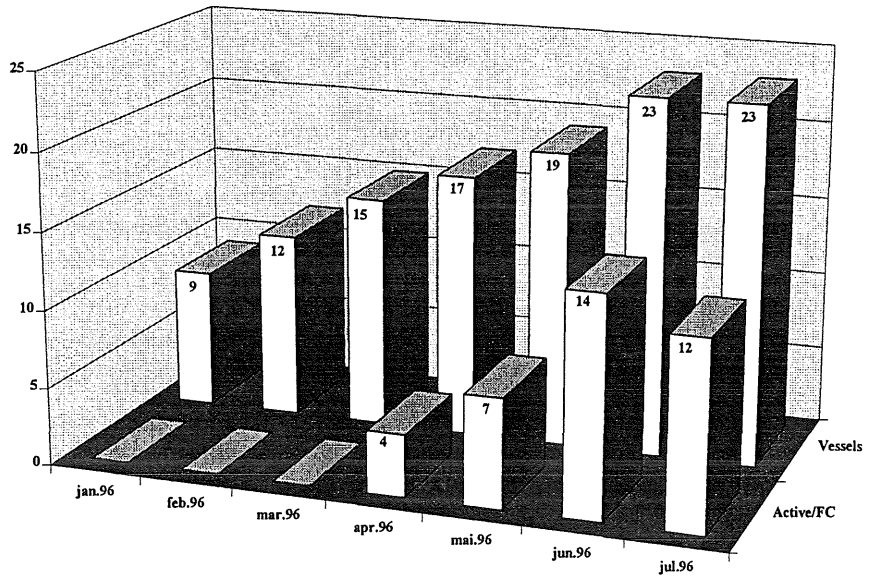

Figure 2) Vessels commissioned and vessels active by month

Be aware that the number of vessels is not equivalent to the number of satellite units. The reason for this is that one of the vessels has carried 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 therefore also carried an Argos transmitter. All Hails forwarded from Norway to the Executive Secretary for this vessel have been generated based on the Argos position reports.

A maximum number of vessels, 15 altogether, were in the NAFO Convention Area simultaneously in early July.

2.2 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 are collected by the service provider and reported to the customer (e.g. 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 predefined group of vessels.

Figure 3 shows the schematics of the data system for tracking purposes at the Directorate of Fisheries.

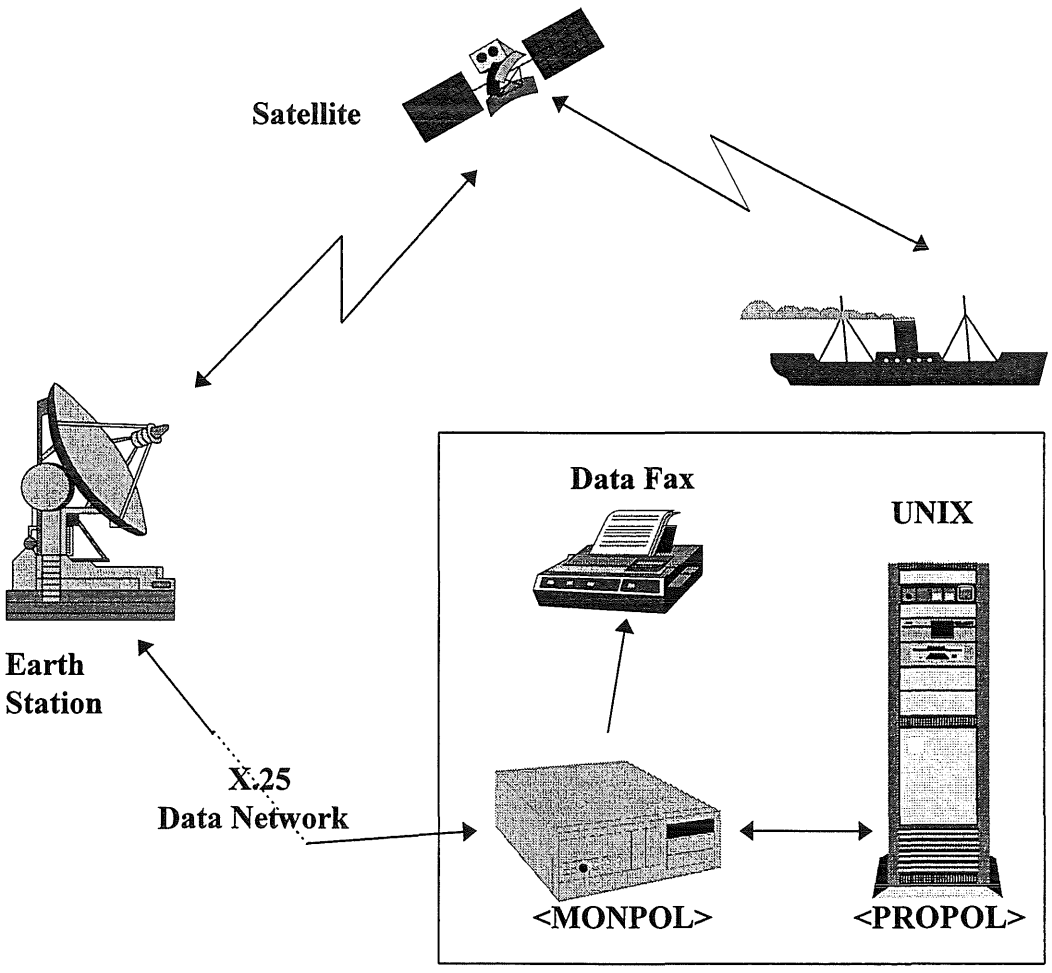

Figure 3) Data system for tracking purposes at the Directorate of Fisheries

The system is set up as 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 off 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 reporting has also been agreed with Euteltracs, but no data on this format has been received during the period covered by this progress report. 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 have so far been 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.

2.3 Platform commissioning problems

All the vessels that had Inmarsat-C units already installed by the start of the trials had *Trane & Trane* equipment. A fair number of those units had been in operation for some time; but on the other hand, some had also rather early releases of firmware. A total of three cases of malfunctioning were detected during the initial tests. In two cases, it was detected that the units reported positions as eastern, instead of western longitude. This was found to be caused by faulty firmware (rel. 2.00). There was also one installation which occasionally gave the wrong date, possibly due to a bit error. In all three cases the errors were fixed well before sailing for the NAFO area.

While being activated for polled Inmarsat-C position reporting, the unit must be logged in to the relevant satellite for confirmation, although the exact procedure varies between the various types of unit. In our case special concern had to be given to the West Atlantic commissioning, as the vessels could prefer to stay tuned to the East Atlantic (AOR-E) satellite while in waters east of about 40°W.

It was also necessary to ensure that the Inmarsat-C units had the clock properly set to UTC, instead of Local Time.

Of the Argos equipment installed on board vessels, 5 units have been of the type Mar-GI, 1 of type Mar-GE and 2 of the traditional type Mar-90. We were particularly eager to evaluate the GE set, as this unit is somewhat easier to install than is the GI. The Mar-90s were included as they were available from earlier tests. Originally they were intended as secondary units only, but one was commissioned as the sole unit for its vessel because of problems of delivery due to strikes in the French transport sector at the end of December 1995.

Altogether there were two problems with the GI commissioning. In one instance the GI was installed in Reykjavik (Iceland), but no position reports of any kind were received. On later inspection in Norway, before sailing for Flemish Cap, it was found that a wrong type of coaxial cable had been substituted during the installation for the cable supplied together with the unit. The equipment did function properly as soon as the cable was replaced. The other instance has been a GI installation where most of the time it has been possible to have only the default Mar-90 positions reported. As the installation has so far not been checked, no reason for this has been established. The performance of this unit has been grouped and analysed together with the data from the Mar-90 platforms. It can of course be argued that this unit should have been retained as a GI platform also for purposes of analysis.

The GE unit has been giving positions mostly as GPS-type but occasionally also in Mar-90 mode. Efforts will be made to find the reason for this when the vessel returns to a Norwegian harbour.

One Mar-90 unit was also improperly installed, but this was put right by having the crew reinstall the transmitter aided by instructions via radio.

Finally, a coaxial cable connector was short circuited during the initial installation of the Euteltracs unit. This was put right after one week.

It is worth mentioning that the initial installation had been carried out by professional personnel in all instances where these problems did occur.

2.4 The Hailing System

NAFO FC/Doc. 95/24 makes no specific recommendations as to the format and standards to be followed for the reporting of Hails. It does, however, in section 8, list Universal Time Count (UTC) and World Grid System 84 (WGS-84) as possible options. Further, it draws 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 (whether active or not)

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 also 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.

Preferably, X.25 was our first choice as reporting media, with possible use of X.400 E-mail as a second best. 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 standard format. This has not been added for the 1996 trials, but should be incorporated if the same format is used for 1997.

An example of hail messages submitted by fax is given in Appendix 1.

3. RESULTS

3.1 Framework

To allow for a proper analysis of the data from the Pilot Project, it was established in national Norwegian regulations for 1996 that the fishing vessels going to the NAFO area should report their positions by means of an automatic satellite system if inside an area delimited to the east of 37°W and to the north of

62°N, in addition to the whole of the NAFO Convention Area. This area, which is larger than the Regulatory Area, and also of the Convention Area, we shall in this report call the *Tracking Area (TAR).*

In addition to the position reports thereby obtained, the Directorate of Fisheries also signed agreements with some of the fishing vessels allowing us to read their positions for trial purposes also when outside the TAR. All positions obtained are covered by a license from the Norwegian Data Inspectorate.

During the trial period, our system has simultaneously also been used for another trial, involving vessels of the Institute of Marine Research.

3.2 Position reports, Inmarsat-C and Argos

The total number of individual position reports received by us for the trial period so far (January - July) is in excess of 58 000. Of those reports, 56 439 have come from vessels involved in the NAFO trials. The number of reports from within the TAR has so far been 27 203, as compared to 25 275 from the NAFO Convention Area. No effort has been made to single out the positions from the Regulatory Area. Identical positions reported several times for the same event, as with Mar-GI/GE, have been counted only once, and are stored as the earliest occurrence.

Table 1 - Tracking Area Position reports by Subdivision

January - July 1996

	1F	2J	3K	3L	3M	St. John's	Other	Sum
Number	137	23	169	1 170	23 776	1 440	488	27 203
Percent	0.5	0.1	0.6	4.3	87.4	5.3	1.8	100.0

The positions from within the TAR distributed by subdivisions are given in table 1. A total of 1 928 (7.1%) of the position reports have come from outside the Convention Area, here also included 1 440 reports from St. John's/Harbour Grace. Position reports from subdivisions other than 3M are normally caused by harbour calls.

Of the position reports from table 1, a total number of 27 098 had timestamps that enabled us to calculate the average time it takes for a position report to reach the Directorate of Fisheries, the *Reporting Delay (RD).* This worked out to be 58 minutes.

Table 2 - Tracking Area Position reports by type of unit January - July 1996					
	Mar-90	Mar-GE	Mar-GI	Sum Argos	Inmarsat-C
Number	1 700	3 778	3 268	8 746	18 457
Percent	6.3	13.9	12.0	32.2	67.8

The first Norwegian vessel only sailed for the NAFO area at the end of March. Table 1 therefore actually covers only the months April - July, as the early months have no relevant data. Table 2 specifies the position reports from table 1 by type of satellite unit.

As will be elaborated later in this report (chapter 3.4), there were a number of events during the first two or three months of the trial which renders the early data reports unsuitable when it comes to calculating the actual performance of a position collecting system for regular tracking operations. We have therefore screened the data available to see whether there is a 30-day period without any events that could complicate an objective analysis.

Such a period exists from 2 until 31 July 1996, both dates included. This period combines a reasonable amount of traffic, as it covers a period of significant activity within the Regulatory Area, with the benefits of better tuning. Results such as measured RDs for this period can give some indication of the performance of the entire system.

Table 3 - Tracking Area Position reports by Subdivision 30 day period								
	1F	2J	3K	3L	3M	St. John's	Other	Sum
Number	15	4	15	637	9 363	715	63	10 812
Percent	0.1	0.0	0.1	5.9	86.6	6.6	0.6	100.0

Table 3 gives the data from the TAR for the 30-day period. The table corresponds to table 1, which lists the total amount of data from within that area.

As one can see from table 4, 10 812 reports have produced an average Reporting Delay (RD) of about 44 minutes, which is fairly good. On an average, 3 258 Argos reports have shown a delay of 123 minutes, or close to 2 hours. Bear in mind our hourly cycle of data reporting from the Argos hub.

Table 4 - Tracking Area Reporting Delay by type of unit 30-day period						
	Mar-90	Mar-GE	Mar-GI	Sum Argos	Inmarsat-C	Sum
Positions	344	977	1 937	3 258	*7 554	10 812
Percent	3.2	9.0	17.9	30.1	69.9	100
Minutes RD	149	117	122	123	10	44
*Hereof 7 541 position reports included in calculation of delay						

The number of reports in some of the groups is rather small, and the data should consequently be used only as an indication of the actual range.

As far as we know, all the Inmarsat-C units employed by Norwegian vessels so far during the trial have been of a type where the minutes are reported from the GPS signal, but where the hour may be adjusted in relation to the UTC time zone. Not all types function in this way. Therefore, since the average delays are small, wrong settings of the unit clock can affect only the hour, and should be easily detected.

But the data also reflects customer installation decisions, especially queuing delays etc. before processing at the Directorate of Fisheries. The impact of such (minor) delays will be larger in relation to a small average RD. This will have special relevance for Inmarsat-C.

Hailing delays for the whole of July are given in paragraph 3.4. See also this paragraph for detailed definitions of the various types of delays.

3.3 Position Reports, Euteltracs and the Canadian-OmniTRACS

BOATRACS has been our service provider for the Euteltracs/OmniTRACS systems. The set-up has been configured with the ship owner as the *Master Account* and the Directorate of Fisheries as a *Sub Account.* Position reports were to be provided on an hourly basis. The reports were uploaded by modem to a pair of GeoTrek systems, either from the Euteltracs hub, or from the OmniTRACS hub for the Canadian coverage.

Based on our experience from earlier domestic trials, it was decided that the vessel should be equipped with a new type low-angle antenna, which was expected to provide improved coverage in marginal areas.

Depending on the command used to down-load the position reports, a Sub Account may in some instances not receive all the positions that could theoretically be available. Regarding the outbound voyage from Norway to the

NAFO area, Euteltracs has therefore kindly placed at our disposal their own comprehensive log of position reports and other technical data. The extra data thereby obtained, has enabled us to perform a more detailed analysis than would otherwise have been possible. The conclusions as to the area of coverage confirms what has been found from an analysis of the data from the Sub Account.

For the period covered by this progress report, the *European Messaging Satellite (EMS)* has been positioned at 25.5°E, and the *European Ranging Satellite (ERS)* at 7°E.

The *Canadian Messaging Satellite (CMS)* has been at 111.1°W and the *Canadian Ranging Satellite (CRS)* at 107°W.

The Canadian pair of satellites do not have the optimal longitudes for a NAFO area coverage, nor is their angular separation very large. Despite this, BOATRACS believe that the coverage is sufficient to provide unit positioning and messaging in the NAFO area.

From earlier tests, the Euteltracs system could not be expected to cover the whole of the area from Europe towards 42°W. The position where BOATRACS unit could make contact with the Canadian-OmniTRACS system was therefore of particular interest.

The Euteltracs position reporting started to deteriorate somewhat at about 21.4°W. At first, the loss of contact was for periods of a few hours only, typically at around midnight. Eutelsat informs us that this problem has now been put right. Contact was finally lost, with the last position reported on 28 May 1996 as 50.294°N / 38.834°W, bearing west. On a rough calculation, the apparent elevations of the two satellites as seen from the vessel were then 7.6° (EMS) and 18.2° (ERS). The loss of position reports was due to the ERS.

The first position report obtained by the Canadian-OmniTRACS system was found to be 48.261°N / 44.531°W on 30 May 1996. The CMS then had an approximate apparent elevation of 6.9° and the CRS 9.5° as seen from the vessel.

The vessel left the NAFO Convention Area on 5 July 1996 bearing north-east. The last position reported from the Canadian-OmniTRACS system was 47.783°N / 43.412°W on 4 July 1996. Approximate elevations for the their two satellites were then 6.3° (CMS) and 8.9° (CRS) respectively.

The first position reported thereafter from Euteltracs was 58.583°N / 31.897°W on 7 July 1996. Approximate elevations for their satellites were then 7.8° (EMS) and 15.6° (ERS). All calculations of elevations have been done by the Directorate of Fisheries based on standard algorithms and disregarding inclination.

The last position obtained from a system in our case tends to be the better guide to the coverage, as the crew would be inclined to stay tuned to the 'old'

frequencies for some time after loss of communication. For this trial the BOATRACS unit was re-tuned for a change of systems.

With the exception of one day, the Directorate of Fisheries was the sole user of the OmniTRACS account while position reports were received from the Canadian-OmniTRACS hub.

While in the NAFO Convention area, in this case counting also St. John's/ Harbour Grace, a total of 486 position reports were submitted to our account for a period of altogether 30 days, this being about 16 positions per day on average. Loss of reports was, however, occurring frequently. There were 75 instances where no position reports were received for periods of more than two hours.

We were unable to carry out a comparison between the Canadian-OmniTRACS data and the Mar-90 positions for the same vessel in time for our progress report. A visual inspection of the data shows instances where such an effort might be worth while.

OmniTRACS may have supplementary data for the reporting period. This report has been based on the data available to us.

3.4 Hails

During the first part of the Pilot Project, from April until the end of July 1996, a total of 144 Hails were generated for automatic transmission by computer. There are two variables of special interest in an analysis of hailing results. The first is the total time elapsed between the de facto crossing of a boundary between subdivisions, as subsequently reported by satellite, and the time when this position report was received by the Directorate of Fisheries. This we have termed the *Reporting Delay (RD).* The second variable is the time interval between the boundary crossing and the time when a Hail to this effect was successfully transmitted from the Directorate of Fisheries. This we will call the *Hailing Delay (HD).* The HD minus the RD is the time spent for internal processing at the Directorate of Fisheries, and time spent trying to connect to the recipient. This we will term the *Processing Delay (PD).*

The RD depends on many factors. With Inmarsat-C it basically reflects the load on the satellite system if the platform is within reach of the satellite(s). With X.25 the time it takes to report back to the customer is very short, normally in the range of a minute or two.

With Argos the situation concerning the RD is rather different. If the satellite is not so positioned when reading a transmitter that it can be simultaneously accessed by an earth station, it will have to store the data for the time it takes to get within such reach. Depending on where the earth station is positioned in relation to the fishing grounds, the RD can become significant. Further, for

technical reasons, it may well be that a later position arrives at the customers before an earlier. The Directorate of Fisheries decided initially that in such cases, if a hail had already been submitted, no hail(s) would be generated to cater for the earlier position(s). Bear in mind that for the Mar-GI/GE units, a position can be stored internally for some time, so that in some cases a number of valid Hails could be generated in short succession when the batch from that satellite pass was eventually received.

The Directorate of Fisheries decided that for this part of the trials, one would ask CLS/Argos to submit data on a hourly basis. In the worst cases the RD is therefore increased by approximately 60 minutes compared to an instant delivery, while on the average the increase will be closer to 30 minutes. This customer set parameter produce a *Delivery Delay (DD)* which is reflected in the analysis of Argos data.

For Eutelsat position reports the RD is also to a larger extent dependent on the customer set parameters if hub access is by telephone, which it was in our case.

Any failure by the customer (e.g. the Directorate of Fisheries) to respond in a timely manner to incoming reports will adversely affect HD. This can occur for example as a result of a system breakdown or overload. Such situations did arise with us on some occasions. This was for the most part caused by occasional interference between the real time <MONPOL> system and scheduled housekeeping tasks such as saves and virus checking, and was resolved at an early stage. There was also one occasion of system stop due to memory conflicts on a new software release, installed at the end of June. This caused an average increase in HD of 36.8 hours for altogether 6 Hails as it occurred during a weekend, and was by a wide margin the most significant such incident.

There were on occasion some instances where the HD significantly exceeded the RD. Where a reason could be established, this was found to originate with the facsimile system, as the data fax sometimes had to make a large number of calls to be connected. In one instance, delaying two Hails by 6.3 hours on average, this was confirmed by the NAFO Secretariat to be caused by the NAFO fax being inoperable because of a paper jam. To resolve the majority of such situations, the reconnect time-out on our data fax was eventually increased to 18 hours.

In three cases, on 25 and 28 May, and on 2 July 1996, our log cannot show an acknowledgement that the fax transmission has been successful. Later investigation by the NAFO Secretariat confirms non delivery of the three messages. No specific reasons for this could be established by the time of the investigations.

Altogether, for the whole trial we consequently experienced an average RD of 60 minutes, compared to an average HD of 180 minutes for the Hails.

To give a better illustration, table 5 lists all Hails generated during the month of July, distributed by type of unit (ref. paragraph 3.2). On an average, the HD has

been 54 minutes for a total of 71 Hails, as compared to an average RD of 39 minutes. Inmarsat-C has the best profile, with a RD of 13 minutes and HD of 30 minutes on the average. For Argos-GI the average HD is 114 minutes.

See also table 4 for comparisons.

Table 5 - Hails forwarded during July 1996

By type of unit

Unit	Hails	RD	HD	PD
Mar-90	7	81	84	3
Mar-GE	6	145	146	1
Mar-GI	7	96	114	18
Inmarsat-C	51	13	30	17
Sum/Average	71	39	54	14

Remember that on average 30 minutes of the Argos delays originate from the hourly reporting interval (DD) from the hub. Bear also in mind that only 1 Mar-GE unit has been commissioned.

Due to the small number of Hails for each of the Argos groups, the numbers calculated can *not* be significant within each group. Still, the average PDs for Argos and Inmarsat Hails do not vary much, as they really should not do either.

During July, Hails have not been affected by major delays due to teething troubles.

Overall results have shown a few instances where Hails were not generated at a boundary crossing, due to a later Hail being already submitted, or to lack of data. This has not been a big problem, and will normally occur only during rapid steaming through an area. This is an Argos problem, and might be resolved by using a larger number of satellites. During the trial period up till now, Argos position reports have been generated by 3 satellites in European waters, and by 2 satellites at Convention Area longitudes. One more satellite could also provide other benefits. Use of 2 satellites will produce an average of only about 12 sighting opportunities per 24 hours at Flemish Cap (47°N). Hence the average Mar-GI position may be in the region of 60 minutes old when reported alone for infrequent sightings. Add our average 30 minutes parameter set DD, and a total RD of 96 minutes for our small sample is rather good. As the Mar-90 reports no stored positions, average RD for this unit should tend to be less than for the GI/GE types.

With Inmarsat-C, one shall bear in mind that our system has so far during the Pilot Project made no effort to submit a new poll for data if a position report was not forthcoming from a vessel within a reasonable time, but has waited for the next scheduled poll. Such a dynamic evaluation can of course be added, and should be of value in areas of marginal coverage.

The configuration of the system at the start of the trials was set up in such a way that St. John's/Harbour Grace was defined as being outside the NAFO area. A call to St. John's therefore generated a Hail, signalling a movement out of the area. It was felt this was a good idea, and as no recommendation was given as to how to cater for such events, it would also be useful in augmenting the number of events to hail. Each harbour call to St. John's invariably then generated two Hails, one coming in and one going out. Perhaps due to the arrangements with observers, the number of calls to St. John's/Harbour Grace proved to be significant, generating at total of 38 Hails for altogether 19 calls to harbour.

Table 6 - Tracking Area Hails by Subdivision hailed

January - July 1996

	1F	2J	3K	3L	3M	St. John's	Out	Other	Sum
Number	5	3	13	52	47	19	3	2	144
Percent	3.5	2.1	9.0	36.1	32.6	13.2	2.1	1.4	100.0

Appendix 2 shows a chart of the NAFO Convention Area, where all the position reports generating Hails have been marked.

4. OTHER MATTERS

No requests for positioning information have been received from other parties with reference to NAFO/FC Doc. 95/17, Litra B, paragraph 1e by the end of July 1996.

Likewise, no reports from onboard observers concerning interference with satellite systems have been received with reference to NAFO/FC Doc. 95/17, Litra A, paragraph 4.

No data from logbooks, nor detailed reports on daily activity from observers (NAFO/FC Doc. 95/17, Litra A, paragraph 4), have been available in time for consideration in connection with this progress report.

5. CONCLUSIONS

This is a preliminary report, covering the activity from January up till and including July 1996, in time to be distributed at the NAFO 1996 Annual Meeting.

The preliminary report has been based on data available in early August 1996. Consequently, there will always be a possibility that factors not known at the time of writing may prove to be of significance in a later final evaluation.

Based on our experience so far, however, it should be possible for the flag state to operate a scheme for fishery control where enforcement measures may be enhanced by means of satellite tracking, in combination with a Hailing system.

The Pilot Project has so far been of value in focusing attention on matters which will be critical for the proper functioning of such an operation.

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, zzzzz respectively for the two vessels.

APPENDIX 2: HAILS FROM THE NAFO CONVENTION AREA

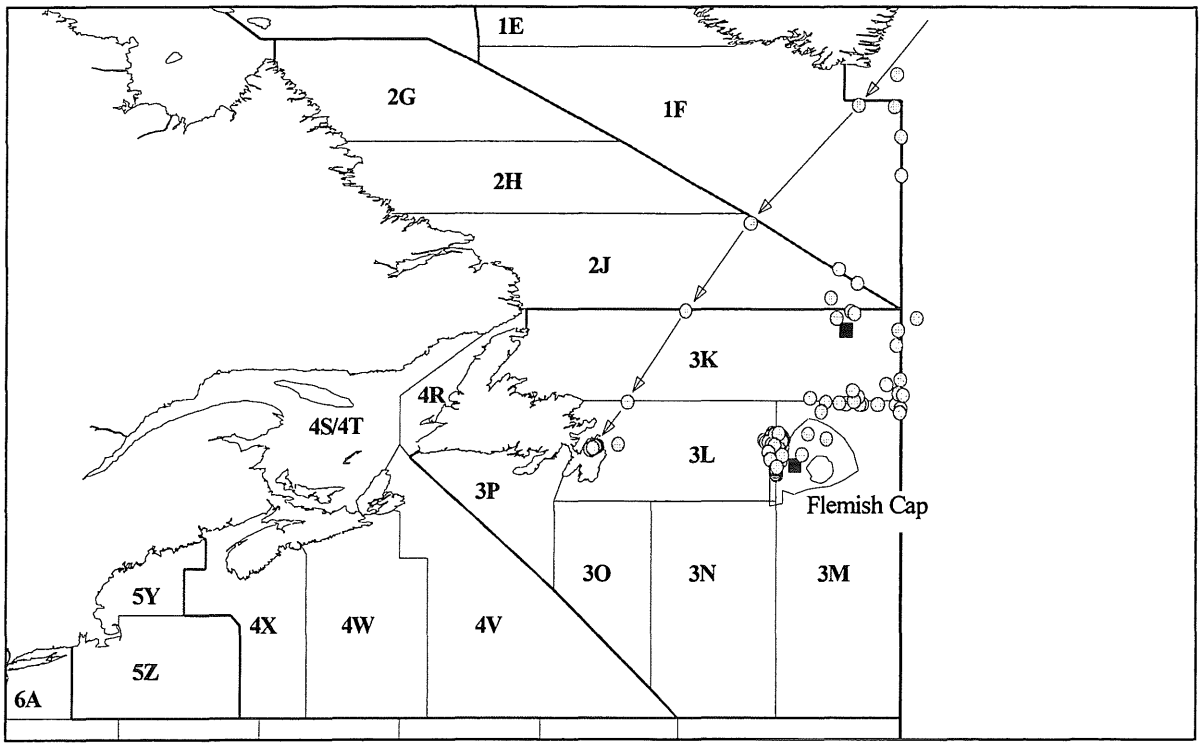

Figure 4) The NAFO Convention area, Hailing positions indicated

Figure 4 shows all the Hails received between 8. April and 31. July 1996. A vessel steaming through the area produces a series of Hails as it crosses subdivision lines, as indicated by the arrows above.

A total of four Hails were generated accidentally during the early trials (mid. April). Two of those Hails, which came from within the Convention Area, are marked with squares. The four Hails resulted from a request for *Poll Acknowledgement* being issued by us for the AOR-W Inmarsat satellite, causing two vessels to report zero position, and thereafter their actual positions (squares). The system was subsequently changed to recognise such situations.

APPENDIX 3: ABBREVIATIONS

The following abbreviations are used in this report:

AOR-E	Atlantic Ocean Region East	(Inmarsat Satellite)
AOR-W	Atlantic Ocean Region West	(Inmarsat Satellite)
CMS	Canadian Messaging Satellite	(OmniTRACS Satellite, Anik E1)
CRS	Canadian Ranging Satellite	(OmniTRACS Satellite, Anik E2)
EMS	European Messaging Satellite	(Euteltracs Satellite, 1F4)
ERS	European Ranging Satellite	(Euteltracs Satellite, 2F4)
GPS	Global Positioning System	
ISO 8859.1	ASCII extension 8-bit code set, often called 'ISO Latin'	
LES	Land Earth Station (Inmarsat)	
DD	Delivery Delay	
HD	Hailing Delay	
PD	Processing Delay	
RD	Reporting Delay	
Mar-90	Argos Mar-90 transmitter, traditional unit	
Mar-GI	Argos Mar-GI (GPS-type) transmitter	
Mar-GE	Argos Mar-GE (GPS-type) compact transmitter	
NEZ	National Economic Zone	
TAR	Tracking Area (here the NAFO Convention Area plus easterly bordering area)	
UTC	Universal Time Count (ref. GMT)	
WGS-84	World Grid System (for latitude/longitude)	
X.25	Data protocol for digital data interchange	
X.400	Data protocol for E-mail interchange	

Data exchange format abbreviations mentioned in report:

LA - Latitude	(EU)	RA - Reporting Area	(new)
LO - Longitude	(EU)	RC - Radio Call sign	(new)
XR - External Reference	(EU)	SQ - Sequence number	(new)