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MONITORING HIGH SEAS FISHING VESSEL OPERATIONS BY SATELLITE

(Submitted by the delegation of the United States of America)

INTRODUCTION

1. The use of remote sensing and satellite monitoring systems allows for more cost-effective monitoring, control and surveillance (enforcement) of high seas fisheries conservation and management measures. Starting in 1988, the United States successfully embarked on a satellite-based vessel-monitoring programme to locate foreign fishermen and monitor compliance with area restrictions on the high seas of the North Pacific Ocean.

2. From 1988 until 31 December 1992, the United States monitored the operations of up to 775 foreign vessels and conducted tests of new vessel-monitoring system (VMS) technology. This paper describes the background, implementation and current technical aspects of the programme. It discusses the results of tests conducted on new systems, discusses specifications and costs and considers future applications to high seas fishing operations.

I. BACKGROUND AND IMPLEMENTATION

3. During the past decade, the development of the North Pacific high seas squid drift-net fishery has come to be of significant concern to world-wide fishing and environmental interests. Fishing and environmental interest groups are disturbed by the fact that the fishery uses a technique that results in the entanglement and death of the marine resources of the coastal states.

4. In 1989 and 1990, the United States negotiated three drift-net agreements. On 12 April 1990, a tripartite international drift-net fishing agreement was signed which, among other things, required real-time automatic satellite position fixing devices (transmitters) to be deployed on all of one party's

squid and large-mesh drift-net fishing vessels operating in the North Pacific from 1990 on. These transmitters allowed automatic, real-time monitoring of the location and identity of each vessel by national officials. Similar bilateral agreements were reached with two other parties in 1989.

5. Parties to the agreements deployed approximately 775 vessels, all equipped with transmitters, to conduct drift-net operations in the North Pacific Ocean in 1990. Each country agreed to fund the purchase, installation, maintenance and data-processing costs involved in this programme. These countries agreed to provide the United States authorities with real-time access to the satellite-generated position data.

6. By every measure, the high seas drift-net fishing vessel monitoring programme was a huge success. In no other area of the world does any other country or international organization monitor fishing vessels in greater numbers or with greater accuracy. Many countries are using this satellite monitoring programme as a model in developing, testing and implementing their own vessel-tracking and fleet-management programmes.

II. THE ARGOS SYSTEM DESCRIPTION

7. The nations party to the drift-net agreements chose the Argos vessel-tracking system for its cost, size, installation convenience and reliability. The Argos shipboard equipment consists of a small transmitter mounted outside the pilot house or on a mast. The transmitter runs off shipboard 12-volt DC power. Signals from the transmitter are broadcast about every two minutes, and are picked up by two National Oceanic and Atmospheric Administration (NOAA) polar-orbiting Tiros-N satellites. In the North Pacific Ocean, positions were received from the drift-net vessels about 10 times per day. At present, one party conducting trial fishing in the central Bering Sea "doughnut hole" has equipped its pollock trawlers with Argos transmitters and has agreed to provide United States authorities with real-time position information.

8. The information sent by the transmitters is stored in the satellites until they pass over an Argos earth-data station. The data are then transmitted to the earth station and relayed to a processing centre (in this case in Toulouse, France), where the signal is converted into readable position information. End-users, through a personal computer using two levels of passwords, access the data stored at the Argos processing centre. The data are then manipulated, printed and/or displayed on mapping software. A mapping/tracking software package called Enhanced Location Software for Argos (ELSA) is used to monitor vessel positions on the computer screen. Boundaries for open and closed areas are part of the software.

III. TESTS OF OTHER VESSEL-MONITORING SYSTEMS

9. In preparing for additional international programmes and anticipated domestic applications of fishing-vessel-monitoring technologies, the United States conducted a successful demonstration of three such technologies off the northwest Hawaiian islands. The systems used for the demonstration were Argos,

International Maritime Satellite Organization (INMARSAT) Standard-C/GPS (Global Positioning System) and HF Radio/GPS. 1/

10. The Argos transmitters used in the demonstration were similar to those being used on the foreign drift-net fishing vessels, with one exception. The Argos transmitters used had peripheral keypads which were programmed to allow the vessel operator to send short messages each time the position information was transmitted.

11. The second system employed in the demonstration also used GPS navigation equipment for position determination and used a high-frequency radio to transmit the GPS position information to shoreside receivers.

12. The entry onto the world market of the INMARSAT store-and-forward communication technology, called Standard-C, resulted in a need to demonstrate this new system. When coupled or integrated with appropriate navigation equipment, such as GPS, an INMARSAT Standard-C transmitter can automatically send accurate position reports to the end-user. The transmitter/GPS unit can be used alone to transmit vessel position data or can be used with a personal computer and printer for two-way communications. Unlike Argos, INMARSAT Standard-C transmitters do not have to wait for a satellite to pass overhead. Position data can be requested at any time by the end-user and it will be transmitted. This ability to "poll" certain vessels is useful for enforcement officials in the monitoring of suspected violations of conservation and management measures.

13. All three fishing-vessel-tracking systems proved their ability to provide accurate and confidential position information. In addition, although not a specific requirement for the demonstration, the Argos system provided confidential one-way messaging and the INMARSAT Standard-C system provided confidential two-way communication capabilities.

IV. SYSTEM SPECIFICATIONS

14. Several companies manufacture and distribute VMS throughout the United States and world wide. Not all systems, however, are compatible with each other. For several reasons, the United States is considering requiring system compatibility for United States vessels. First, fishing vessels that engage in multiple fisheries should not be required to install multiple VMSs. Furthermore it would not be cost-efficient for the United States to install multiple fishing-vessel-monitoring centres/systems in order to monitor vessel activities from multiple VMSs. In order to assure such compatibility, the United States is proposing basic VMS performance criteria and system specifications for its vessels.

15. System standardization for vessels from any country that may operate in their own coastal waters, in international waters or in the coastal waters of another country, or a combination thereof, is important for the reasons stated previously. The proposed United States specifications are outlined below for consideration by the international community:

(a) The VMS shall be tamper-proof, i.e., it shall not permit the input of false positions;

(b) VMS equipment shall be fully automatic and operational at all times, regardless of weather and environmental conditions;

(c) VMS equipment shall be capable of tracking vessels throughout their range and shall provide position accuracy to within 400 metres (this requirement may vary by fishery);

(d) The VMS shall have the capability of transmitting and storing information, including vessel identification, date time latitude, longitude, speed and bearing;

(e) The VMS shall provide accurate position transmissions, the interval between which to be determined by those monitoring the vessel and capable of being set or changed remotely. In addition, the VMS shall allow the monitors to poll individual vessels or any set of vessels at any time and receive position reports in real time;

(f) Under certain conditions, the VMS may be required to provide network message communications between the vessel and shore. (This specification may not be applicable to tracking-only systems). Such communications shall include, but not be limited to, transmitting and receiving telex and full or compressed data messages to and from shore. The VMS shall allow the monitors to initiate communications or data transfer at any time;

(g) Shore station software shall reliably retrieve position records, as defined in subparagraph (d) above, and display such data on a computer monitor. The software must also provide a means for printing such data. The software must include on-screen displays of charts capable of showing boundaries of fishery management areas. The software must be capable of accurately displaying vessel positions on such charts. The software must be capable of providing an alarm, signal, or other notice to shore station operators when a vessel is within 1 nautical mile (1.9 km) of designated closed areas or management area boundaries. The software must provide printer/plotter support for drawing charts. It must have the capacity to archive vessel-position histories for a minimum of one year.

V. COSTS

16. The full range of VMS equipment manufacturers is not known. The cost of hardware equipment from the leading known manufacturers contacted by United States fishery enforcement officials, ranges from $1,000 to $15,000. However, the United States expects the average vessel-tracking-only hardware to cost between $5,000 and $8,000 for equipment which meets VMS specifications. Data-reporting-only or vessel-tracking and data-reporting applications may require the addition of a personal computer and possibly a printer. This could add $1,000 to $3,000 to the cost of the system.

17. The other major cost involved with VMS is that of transmitting data to and from the vessel. Estimates for the cost of vessel-position reports range

between $500 and $1,000 per year per vessel, as the frequency of position reports will vary from one fishery to another. Costs associated with transmitting catch data, other business data and personal data over vessel-monitoring systems varies from one system to the next and cannot be estimated accurately. However, some systems impose a monthly service fee ($70-$80) that includes a limited number of position reports and messages. Additional charges accrue based on the number and length of messages.

VI. POSSIBLE FUTURE APPLICATIONS

18. Law enforcement experts and fishery managers envision many opportunities for developing, promoting and applying satellite technology to the monitoring of vessel and fleet operations in coastal waters and on the high seas. In remote areas of the world, conducting effective surface and aerial patrol operations is cost-intensive. At present, real and potential satellite vessel-tracking projects include operations for the central Bering Sea and numerous domestic applications.

19. Vessel-tracking systems with one- or two-way communication capabilities will greatly assist fishery managers and compliance monitors under proposed individual-vessel quota management regimes. A real-time satellite-based catch reporting system will enable managers to monitor catches, quotas and transfers as they occur and will enable enforcement officials to receive catch reports in a cost-effective manner from the time the catch is brought on board. Where collecting, reporting and disseminating environmental data in real-time is important, this technology is ideally suited. As a safety device, some systems can send distress messages that describe the vessel's position anywhere in the world with an accuracy of 15 to 500 meters.

CONCLUSION

20. Fishery managers, scientists, and law enforcement officials have discussed, studied, deliberated and examined the concept of fishing-vessel-tracking or monitoring systems, often called "black boxes", for over 20 years. The reason is simple. Resources for fisheries surveillance and enforcement are limited, so they must be used effectively. A vessel-monitoring system contributes significantly to cost-effective enforcement of high seas fisheries conservation and management measures. The United States is extremely pleased with the results to date using this technology and is interested in monitoring the location of fishing vessels by satellite and applying associated technology capable of transmitting catch, weather, and other data on a real-time basis.

Notes

1/ Harman, Mager and Springer, Fishing Vessel Tracking: Application for Fisheries Management and Enforcement (Silver Spring, National Marine Fisheries Service, 1991).
