Spill and illegal discharge detection

The aerial detection

The aerial detection

- Background
- Remote sensing aircraft
- Objectives of aerial surveillance
    - accident
    - illegal discharge
- Conclusion

HISTORY OF AIRBORNE OIL POLLUTION SURVEILLANCE

When the oil tanker Torrey Canyon ran aground in 1967 off the coast of Cornwall and produced at that time the largest oil pollution (119.000 tons of Kuwait crude oil) of the sea in history, politicians, environmentalists And people at large became aware of the potential impact on the marine environment from such accidents. Transportation of oil across oceans, seas and smaller marine environments in general came into focus and soon a new research community for studies of the problem was established, primarily in Europe, Canada and the United States.

In 1969, birth of the Bonn Agreement

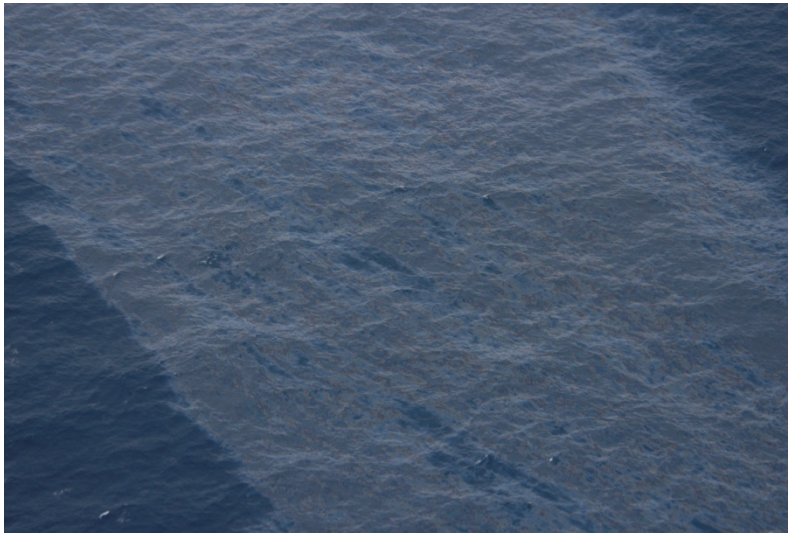
Torrey Canyon

It became apparent that sizeable oil spills from grounding and collisions at sea could be reduced by improved international legislation regarding marine navigation. Double hulls and tank separation in new tanker vessels would also reduce the risk of very large spills in connection with accidents.

HISTORY OF AIRBORNE OIL POLLUTION SURVEILLANCE

Another and potentially more long term damaging effect from oil pollution of the sea would come from deliberate discharges of oil from tankers in connection with the release of ballast water and from ships in general when they clean their bilges. In addition, intensive exploration in certain off-shore areas would contribute to the marine pollution. This continuous accumulation of pollutants to the seas would be devastating in many parts of the world to marine life including sea mammals, fish, corals and marine vegetation.

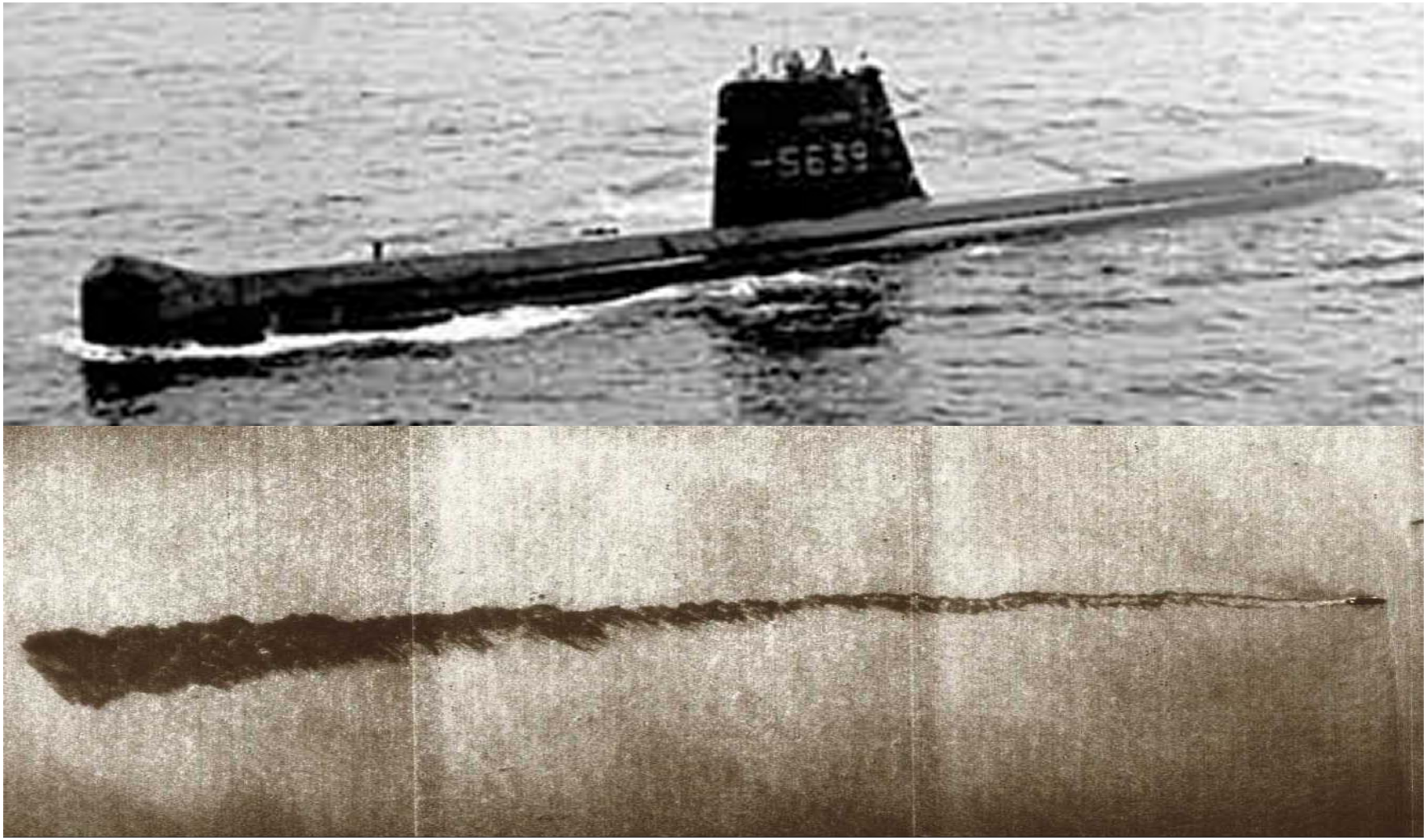
IMO set up working groups to establish an international legislation for discharge of oil at sea. The laws resulting from this endeavour, eventually called *Marpol 73/78.* Open seas and coastal zones were given definitions in relation to how much oil could be released by ships in motion aiming at maximum dilution at relative ”safe” distance from sensitive areas.



The quantities that could be legally discharged were very small. Therefore, it became important to establish procedures to enforce the law. Monitoring ship traffic and oil discharges from shore based installations or patrol vessels would be prohibitively expensive and technically inadequate. The first earth observation satellite, ERTS-1 had been launched in July 1972 with a very crude multi-spectral scanner, no cloud cover penetration and infrequent coverage of any specific area. As a result, the only option would be to an airborne pollution monitoring network.

Research and development of airborne sensors which could detect, identify and quantify oil on the sea surface started in the early seventies but no co-ordinated international effort existed to equip surveillance aircraft.

History of National Oil Pollution Surveillance Programmes



Discovery of IR properties for oil pollution

History of National Oil Pollution Surveillance Programmes

- The first country in the world to set up a national oil pollution surveillance programme with remote sensing equipment was Sweden. It was initiated in 1976 and comprised two Cessna 337 « Push Pull » twin engine aircraft. One aircraft was equipped with an X-band SLAR developed by Swedish L.M. Ericsson for oil detection. The other aircraft carried an American Daedalus 1220 IR/UV (infrared/ultraviolet) line scanner for oil cover delineation and volume assessment. The two aircraft flew missions together because the Cessna 337 was too small to accommodate all the equipment. In Denmark Intradan had been operating a Partenavia

The first remote sensing system

History of National Oil Pollution Surveillance Programmes

- The Netherlands, which had flown visual oil spill observation sorties in a Piper Navajo since 1975, started remote sensing surveillance in January 1983 using a Cessna 404 Titan with the same type of sensors as those used in Sweden including the handheld cameras.
- In France, between 1978 and 1982 the first remote sensing aircraft was a CESSNA 337 equipped with an IR scanner « super cyclope », with recording system and data transmission to a mobile station. This experimentation was conducted by LNE
- In 1984, the UK commenced a routine surveillance program with a BN2 Islander aircraft, also equipped with the same system as Sweden.

History of National Oil Pollution Surveillance Programmes

- Germany was the next country to follow in 1985, again with two Swedish surveillance systems on board two Dornier 28 Skyservants. This country was also the first to add on one of the aircraft a 37 GHz Dicke MicroWave Radiometer (MWR), developed by Swedish Space Corporation.

- France started its airborne pollution monitoring programme in 1986 using a Cessna Caravan II aircraft with a Danish Terma SLAR, developed by the Technical University of Copenhagen and manufactured by the Danish company Terma Elektronik. The system included a thermal infrared (THIR) line scanner built by the French company SAT.

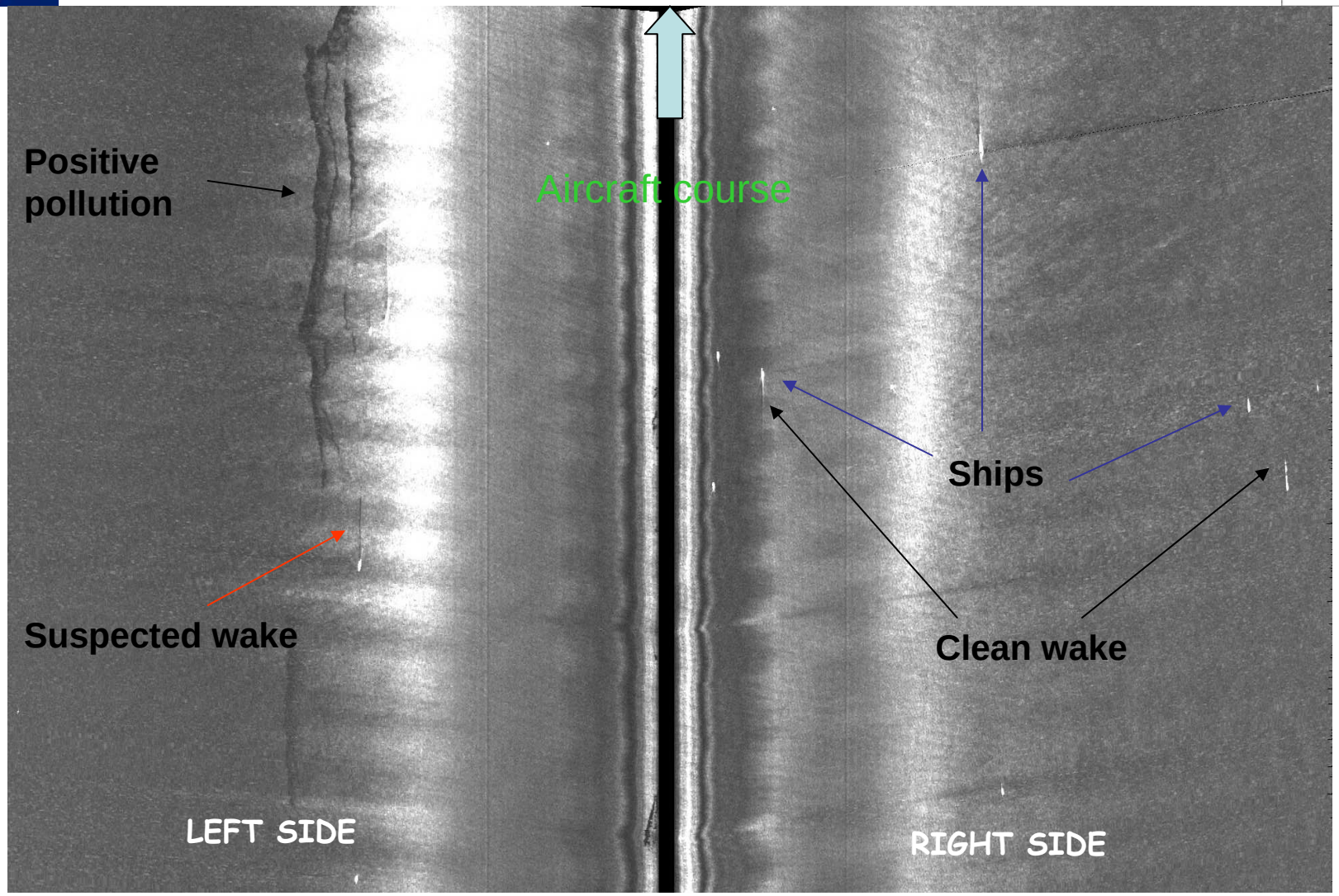
In 1987, Norway procured a Swedish surveillance system to be installed in a Metro Merlin III aircraft. Denmark followed in 1989 with a Piper Navajo equipped with a Terma SLAR, and Belgium in 1991with an Ericsson SLAR in a BN2 Islander.

In Europe, a constant upgrading has taken place in several countries with better, larger and newer aircraft, improved and expanded sensor packages with particular emphasis on the sensor management systems.

« POLMAR » means for detecting pollutions at sea

French custom remote sensing aircraft
REIMS AVIATION F 406

SLAR IMAGE

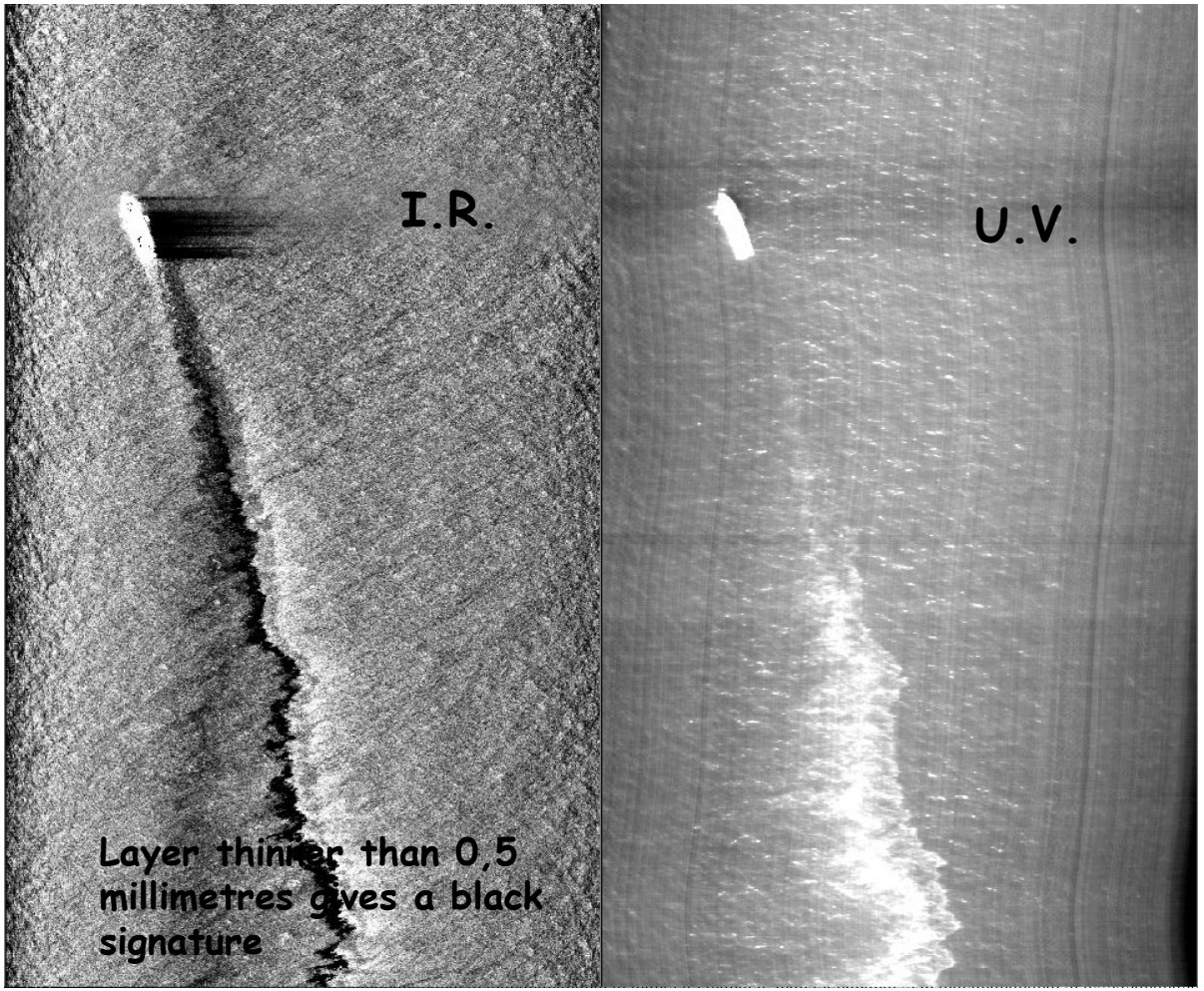

Positive pollution
Aircraft course
Ships
Suspected wake
Clean wake
LEFT SIDE
RIGHT SIDE

PASSIVE SENSORS

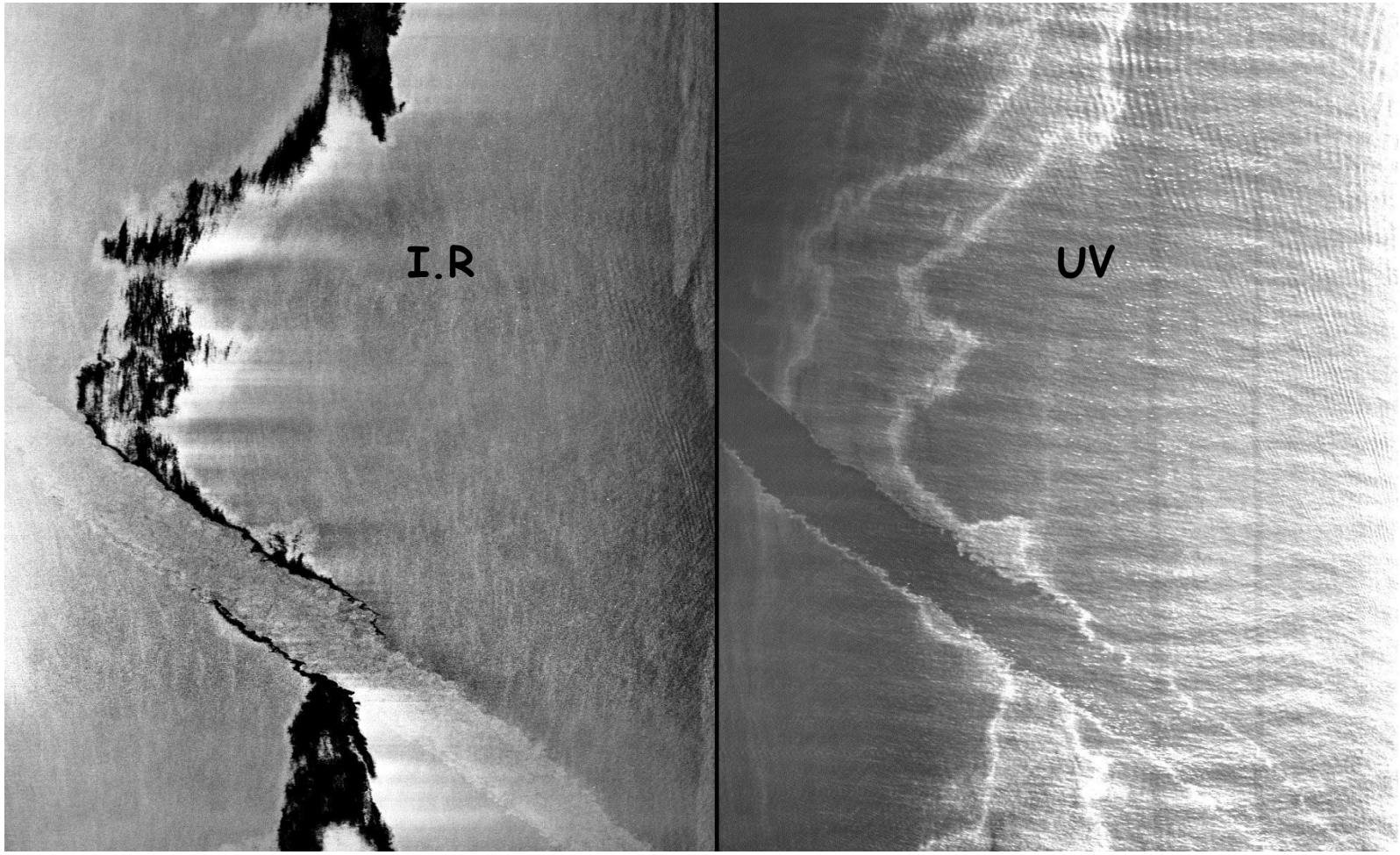
INFRARED and ULTRAVIOLET SCANNERS

IR : This sensor detects infrared radiation. The oil radiates more slowly than the clear sea and shows up variations in grey levels.It provides the capability to obtain information on the relative layer thickness.

UV : As oil is a very good reflector of the ultraviolet component of sunlight, this sensor detects the reflected ultraviolet with a wavelength of about 0,3 micrometers. It cannot distinguish between types of pollution or different layer thickness.



Wake of a ship crossing a polluted area



Identification of a ship at night with LLLTV

Today, most of the identification are provided with AIS

Accident : aerial observation

In the event of an accident, aerial observation is used, to assist in recovery and dispersion operations at sea. The aims of the observation missions are to:

- locate the slicks
- accurately describe the slicks
- map the pollution

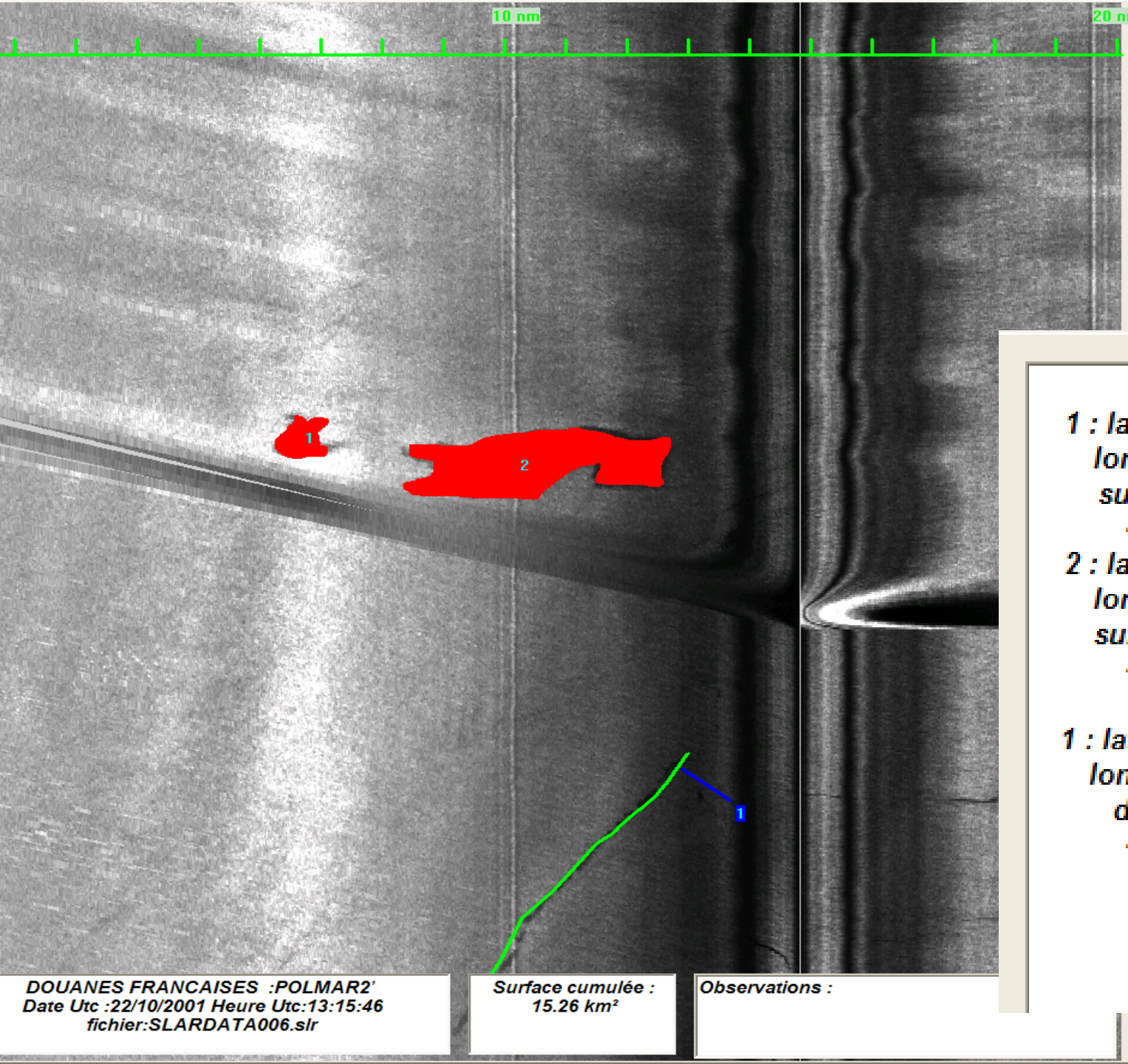
Torrey Canyon

Prestige

in order to:

- monitor the pollution
- adjust drift models
- guide response operations that day
- prepare the response operations for the following days

Amoco Cadiz



nappes:
1 : lat: N042°40.05'
lon:E005°38.32'
surf= 1.7 km²
---
2 : lat: N042°37.11'
lon:E005°35.30'
surf= 13.5 km²

Sillages :
1 : lat : N042°36.50'
lon :E005°23.54'
dim :5932 m
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1 : lat : N042°36.50'
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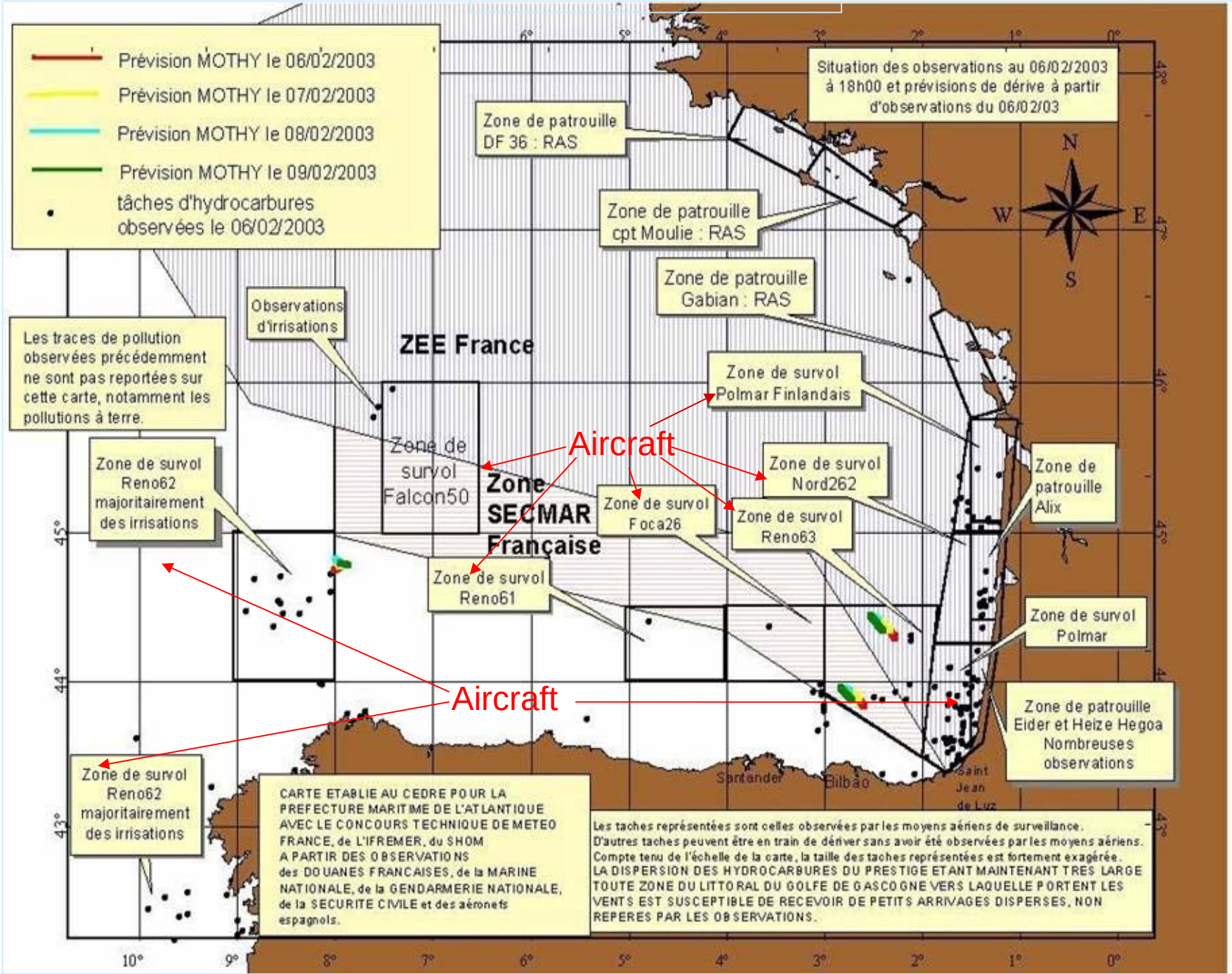
dim :5932 m

DOUANES FRANCAISES :POLMAR2'
Date Utc :22/10/2001 Heure Utc:13:15:46
fichier:SLARDATA006.slr

Surface cumulée :
15.26 km²

Observations :

FEBRUARY THE 06th



Prestige Case : aerial observation

A key element of the fight against the Prestige spill:

- **from 13 November 2002 to 20 March 2003**
- **more than 1200 observation flight hours**
- **2 to 7 flights every day**

A strong cooperation :

- **within the 3 countries directly involved (Sp, Fr, P):**
  - **between national and regional authorities**
  - **between departments**
- **at international level:**
  - **between the 3 countries involved**
  - **with assistance from some European countries**
  - **and from ITOPF**

Some specific issues:

-Flight Safety: it is necessary to coordinate the flights

-importance of liaison officers

-more than 5000 POLREP: data processing

Detection of operational discharges

Aerial surveillance is carried out routinely, to look for and suppress operational pollution by ships.
In this case the aims are to:

- detect the pollution
- accurately locate and describe the pollution
- where possible, identify the polluter

in order to:

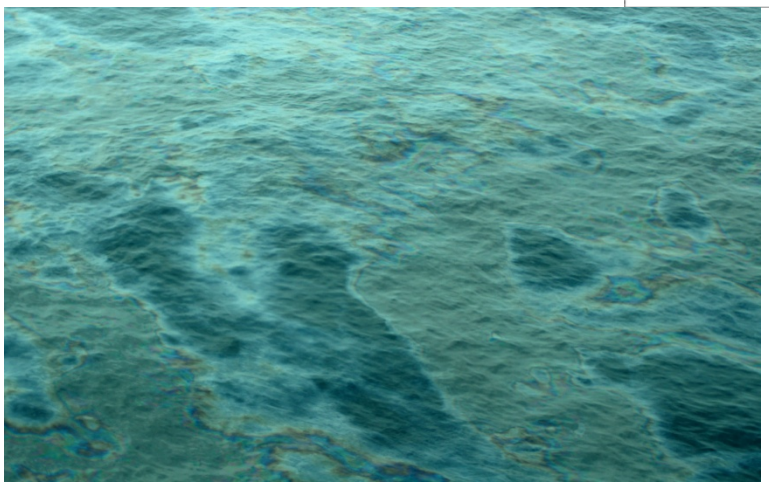
- assess the pollution (quantity and quality)
- anticipate the evolution of the situation
- prosecute the polluter via a pollution observation report

Detection of operational discharges

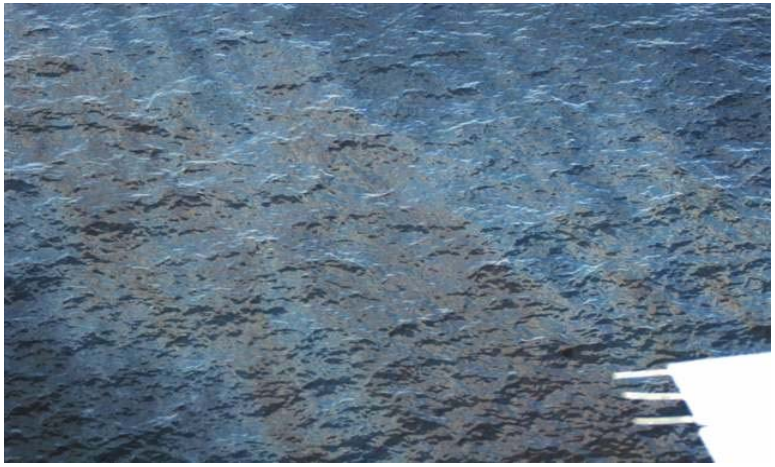
Discharge at sea: visual observation and photos
Visible oil is an evidence of a discharge more than 50 ppm (MEPC resolution 09/07/1993)

Illegal discharge: Visual observation and pictures, trained aircrew and duly authorized officer

Evidence of discharge in the wake and identification of the polluter



Analysis of the details of the discharge with the BA-OAC



Detection and observation techniques

- Remote sensing equipment : daytime and night operations

  At night: The remote sensing aircraft is necessary with all the equipments available (minimum SLAR, Scanner IR and AIS);

  The sum of the collected elements is mandatory to prove we have an oil spill at sea.

- Visual observation : daytime operation

Operational discharges by ships: Some figures

	POLREP	Ships caughted red-handed
• 2007	425	8
• 2008	435	11
• 2009	381	6
• 2010	238	5
• 2011	140	4

The way forward

- To maintain a high capacity of response in case of accident
- To improve our capacity to detect oil discharge
- To improve our capacity to detect air emissions and NLS (Annex 2 and 6 of MARPOL convention)

REMOTE SENSING AIRCRAFT (multi mission)

SPAIN

SWEDEN

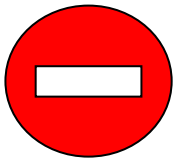
ITALY

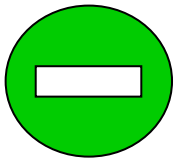
New aircraft: Beechcraft King Air 350ER

Sensor	Nb	Sensor	Nb
Surveillance Radar	1	Scanner IR/UV	1
AIS	1	Marine VHF	1
DF	1	UHF	1
EO/IR turret	1	HF	1
SLAR	1	SATCOM	1

	KA 350ER	F 406
Max. speed Vi	245 Kts	213 Kts
Patrol speed	150/180	150/180
Ceiling	35 000 Ft	10 000Ft
Endurance	8 hours	4 hours
Track number	1500/2500	1000

HAVE YOU SOMETHING TO DECLARE?





THANK YOU FOR YOUR ATTENTION

- Christian.cosse@douane.finances.gouv.fr
- http://www.cedre.fr/fr/publication/guides/guide-operationnel.php: l'observation aérienne des pollutions pétrolières en mer
- http://www.bonnagreement.org/eng/html/welcome.html : publications (aerial operations handbook, Photo Atlas)