PROJECT

DIFIS

Double Inverted Funnel for Intervention on Ship Wrecks

**Funding:** European (6th RTD Framework Programme)

**Duration:** Sep 2005 - May 2009

**Status:** Complete with results

**Total project cost:** €3,182,900

**EU contribution:** €1,800,000

**Call for proposal:** FP6-2003-TRANSPORT-3

**CORDIS RCN:** 90182

**Background & policy context:**

A great number of wrecks exist in the sea or on the ocean bed all over the world, many of them having a quantity of hydrocarbons trapped in their tanks (cargo and/or fuel). Each one of these wrecks constitutes a more or less serious threat for the environment in the shorter or longer term.

Maritime disasters leading to major environmental pollution happen fairly regularly every two to three years: Amoco-Cadiz in 1978, Tanio in 1980, Aegean Sea in 1992, etc. In December 1999, the sinking of the tanker Erika caused a major pollution along the coasts of Brittany and triggered several measures aiming at the prevention of similar maritime catastrophes. Several proposals were made on the prompt mitigation of the results of such accidents, by treating the released hydrocarbons with intervention on the wreck to seal the leaks or pumping the trapped hydrocarbons out. However, few of these proposals went further than the conceptual state; none of them was anywhere close to a practical intervention system.

On 19 November 2002, the tanker Prestige, loaded with 77 000 tonnes of heavy fuel oil, broke apart and sunk 133 miles off Cape Finisterre. At the beginning of December 2002, the Prestige wreck was leaking as much as 125 tonnes of oil every day. Although many of the 20 leaks were stopped by the submersible Nautilus of Ifremer, 14 months after the accident the wreck was still leaking about 350 kg daily. An intervention method through special 'shuttle bags' was developed and tested by the Spanish company Repsol YPF to extract the oil from the wreck. At the end of the process, almost two years after the accident, less than 15% of the original fuel load of Prestige had been recuperated; 25% had leaked before its sinking, while 60% of its original load had slowly dispersed in the ocean during the 22 months it took to plan and implement the intervention.

The Prestige case puts in evidence, among other things, the lack of tools, systems and methodologies for the prompt intervention on shipwrecks in order to confine the pollution and thus eliminate the source of the pollution threat.

**Objectives:**

The scope of the DIFIS project was the study, design (including costing, planning, deployment procedures etc.) and validation of an EU reference method for the prompt and cost-effective intervention and remediation of tanker wrecks dealing with eventual leaks and recuperation of fuel trapped in their tanks even at considerable depths. The proposed method is of general applicability as long as the trapped pollutant does not dissolve and is of lower density than sea water.

**Methodology:**

The DIFIS system is very innovative and most of its components, as well as the deployment and procedures, must be validated and optimised with experimentation as well as advanced modelling techniques and tools prior to proceeding to their detailed design.

The proposed solution, relies on gravitational forces to channel the flow of leaking fuel towards the
surface. However, instead of channelling the flow directly to the surface, where the recovery operation would be greatly affected by adverse weather conditions, the flow of fuel-water mix is channelled to a buffer reservoir/separator some 30-50 m below the sea surface. In that way:

- Recovery operations can be performed when the weather permits (depending on the buffer reservoir capacity) and,
- The whole structure is not affected by rough weather (high dynamic loading due to waves).

The system consists of a flexible structure, as light and quickly deployable as possible, according to the depth envisaged, that should stay in place until all the tanks of the wreck are emptied and the pollution threat is eliminated.

The buffer reservoir, into which the spilt fuel is channelled, is provided with standard equipment, so that shuttle vessels, weather permitting, can recover the fuel rapidly, using standard off-shore equipment and procedures.

The DIFIS system consists of six (6) distinct major subsystems:

1. The Buffer Bell
2. The Riser Tube with
3. Stiffening lines
4. The Dome Interface
5. The Dome
6. The Anchoring System

**Parent Programmes:**
FP6-SUSTDEV-2 - Sustainable Surface Transport

**Institute type:** Public institution
**Institute name:** European Commission
**Funding type:** Public (EU)

**Lead Organisation:**
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**EU Contribution:** €0

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**EU Contribution:** €0

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Key Results:

The DIFIS system promises some significant advantages over the current State-of-the-Art in what
The DIFIS system promises some significant advantages over the current State-of-the-Art in what regards the prompt intervention on ship-wrecks to prevent marine pollution and eliminate the pollution threat:

- The concept is simple: once installed it does not require any valves or other specialised equipment; it has no moving parts and requires no external power; any such operations take place near the surface only at the unloading phase.
- Its installation poses no risk for the structural stability or the wreck; it can be implemented in phases allowing, with the same system / procedure, both the prompt containment of the leaks and the subsequent removal of the remaining hydrocarbons.
- Unloading operations are done near the surface through standard industrial equipment.
- The riser tube configuration can be implemented through a modular design, adding operational flexibility and lowering the cost.
- It is entirely passive: the flow of oil is gravity driven; if necessary, it can be enhanced by other means (i.e. through a heat source or by injecting chemicals at the top of the dome).
- Once in place, it does not require regular deep-sea operations or monitoring.
- The presence of a submerged terminal buoy and a high capacity buffer reservoir make the operations tolerant to the rough surface weather conditions.
- DIFIS can be optimised (anchoring parameters, tube and shuttle bell dimensions, riser tube / wire tensioning, depth of the terminal buoy, eventual intermediate buoys etc.
- The concept is highly configurable and can accommodate further improvements

However simple the concept might be, its realisation presents important technological challenges. Among the biggest challenges, the study has emphasised:

- The realisation and the deployment of the long and wide riser tube, having to operate in conditions of important, unpredictable currents sometimes in rapidly changing patterns.
- The manufacturing, folding, transport and deployment of a large dome. This point has in a first step limited the wished dimensions, and necessitates further developments.
- The whole system deployment, with the objectives to be safe and as quick as possible, can represent a serious drawback in term of cost as bulkiness, sizes and complexity rise as depth of operation increases. This can lead to consider intermediate water depth ranges (less than 1000 m) where the system could be lighter, with more standard naval m

Documents:
- Publishable Final Activity Report.pdf (Final report)

**STRIA Roadmaps:** Other specified

**Transport mode:** Water transport (sea & inland)

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Environmental/Emissions aspects

**Geo-spatial type:** Other