

# Development of the Operational System and Methodology of Determinating the environmental, legal and socio-economic optimal tanker routing through the Aegean Sea for Caspian oil retransportation to the Mediterranean – “AEGEAN”.



## Target

Central target of the project (MINISTRY OF DEVELOPMENT , GENERAL SECRETARIAT OF RESEARCH & TECHNOLOGY) was to develop effective means for assisting shipping companies, assurance agencies, and competent authorities in defining optimal tanker-ship routing through the Aegean Sea, as well as safety precautions and contingency strategies for minimizing environmental risks. The project took under consideration and exploited the potential of the recently launched integrated monitoring system of the Aegean Sea, i.e. the “POSEIDON system”, in order to collect, analyze and compile sea-state information, along with multi-thematic environmental and socio-economic data of the transit area.

A comprehensive background was therefore developed, framed by the interrelated legitimate constrains, regarding navigation safety and environmental protection, laid out by the National, European and International law. Linked to this background, a state-of-art DSS (Decision Support System) was developed for optimal tanker ship route selection, in terms of safety and environmental objectives, along with cost terms of stakeholders, i.e. ship service providers, cargo and assurance companies etc.

In association with the DSS, event-tree and marine adapted SWIFT methodologies were implemented, for operational task analysis along the routes, i.e. transit, anchoring, refuge, transfer of cargo or fuel, ballasting/deballasting, operational discharges, etc. Yet, oil spillage risk contact contours, of the

designed routes were generated through the implementation of spill trajectories modeling. This provided the operational criteria for improving recommendations of safety, infrastructure and procedural operability of the Aegean Sea, as well as for contingency planning strategies efficient to mitigate oil pollution risks. The project comprised an inseparable part of the nationally strategic plan of the Bourgas-Alexandroupoly oil pipeline alternative solution, for transferring Caspian oil reserves to the Mediterranean through the Aegean Sea. It provided scientifically sound means, to facilitate the elimination of any negative pressure against the pipeline project, which may be raised on the basis of possible environmental and economical risks, at the fragile Aegean Sea area. However, the realization of the project was a timely necessity, since the commencement of the Russian oil supply, from the harbor of Novorosisk in the Black Sea, was expected to lead shipping companies to exploit the possibility of oil cargo transshipment from small to large tankers, after passing through Bosporos and the Elispondos straits. Obviously, this increased the risks on the two wellspring staple industries of the Aegean Sea area (i.e. tourism and fishing). Furthermore, the project provided the preparatory study for interfacing the optimal routing DSS with the VTMS (Vessel Traffic Monitoring and Information System), currently installed at the Ionian Sea area, but according to the national priority plans was to be expanded at the Aegean Sea too.



Key feature of the project was the partnership of a wide spectrum of diverse disciplines, such as law, engineering, physical and environment sciences, oil spill response specialists, as well as socio-economic sciences. All these, for almost at first time in Greece, merged their knowledge and techniques, towards the development of effective means at the service of the sustainable development. Due to such a multidisciplinary approach, the project provided an optimum background for improving the related to maritime transportation state-policies, which are expected in the near future to be at high rank in the European Union's agenda. Yet, it enhanced the user benefit reasoning on the deliverables of the proposed project, among a plethora of potential customers of a wide market, that Greece offers as the state with the largest commercial fleet within the Europe Union.

## DELIVERABLES

Safety Specifications

Cost Specifications

Spatio-temporal mesh of climatic sea-state context

GIS of marine / coastal Vulnerability

Short/long term risk analysis report

International conventions

Constraints provided by the Regulations of the International Maritime Organization (IMO)

Economic and livelihood status in the coastal zones

Constraints provided by the current legislation on the coastal zone protection

Constraints provided by the International Conventions and European Directives

Constraints provided by the International Conventions and European Directives



Thematic maps

G.I.S. Data Base

Marine Safety Criteria

Ranking Procedures

Validation Scheme

Oil spill models

Operational & Proactive Recommendations

Recommended Proactive And Reactive -To Oil Spill Incidents- Measures For The Limitation Of Marine Pollution And For The Increase Of Navigation Safety.

A software module that:

1. Proposed environmentally sound routes for oil container vessels
2. Derived best locations for emergency response fleet vessels
3. Estimated best locations for intermediate transshipment oil terminals
4. User Manual for the proposed Decision Support System

## RESULTS

This project was part of the strategical importance project concerning the alternative solution of the construction of the pipeline of transportation of oil reserves of Caspian toward the Mediterranean Sea and especially toward the Aegean Sea and belonged to the works and analysis of the total management plan.

The methodology showed and presented the multiple capabilities of use and choices of the advanced technical and methods of GIS in combination with the environmental legislation. This was a full and multidimensional methodology for the proper monitoring – review of the environmental parameters and phenomena with upper goal of forming management plans of action and programming of works in the broad basin of the Aegean Sea.

The research foresaw, among others, the substantial and effective exploitation of modern methods and technical on the fields of GIS beyond the known common methods and was considered that except from the direct results that gave, contributed to the transmission of knowledge and to the modernization of the methodology for confronting the environmental problems.

On this project the following **results** were accomplished:

Creation of thematic maps with the use of digital satellite data LANDSAT TM, qualitative and quantitative analysis. The final version was in two scales. The first scale was 1/500,000. The second scale was 1/100,000 using the Landsat



data and was chosen in case of economical flexibility as well as for detailed presentation of the results and the emerge of the capabilities and restrictions of the specific satellite data.

Creation of appropriate Data System for the water analysis and depiction of the best transport route of passage of tanker ships with the completion of the possibilities of GIS and the satellite telesurveillance and other environmental, legal and socio-economical parameters.

Examination of a new international protective for the Aegean Sea legal frame preparative to deal with the expected demand of circulation of the tanker ships through ecological sensitive areas.

Development of experienced system of emerging environmentally better transport routes of passage of the tanker ships to the Aegean Sea.

Examination of the possibilities and restrictions of the connection of the experienced system with the existing system VTMISS of the Ministry of Merchant Marine.

### **Impetus Role**

IMPETUS was the basic partner and LEADER of the Project. Impetus was responsible for:

- Creation of thematic maps.
- Creation of a single data base.
- Report containing all the coasts of pollution concentration (oil slicks and waste) after the observations and studies of the satellite photographs.
- Analysis of the transport cost, recording of the accidents in the Aegean.
- Creation of a suitable Information System on the territorial analysis and depiction of the most optimal road for the passage of oil-bearing boats with the use of Geographic Information Systems of (GROUND) and satellite observation and other environmental and legal and socio-economic parameters.
- Argued proposal for the statement of the Aegean Sea as a Special Region of Marine Protection (Protected Special Sea Area - PSSA) with recognition by International Shipping Organism (I.M.O.).
- Growth of a system of appointment for the most optimal roads of passage of oil-bearing boats in the Aegean Sea.
- Investigation of possibilities and restrictions to the connection of experienced system with the existing VTMISS system of the Ministry.