



# NAVDEC



**SUP4NAV** has been established by a group of scientists at the Maritime University of Szczecin, creators of NAVDEC, a navigational decision support system. The company is launching the technology with assistance from the investor Polish Entrepreneurs Foundation.

## Description

The NAVDEC system particularly supports the navigator in making right decisions in a collision situation, and generally assists navigators in the process of safe ship conduct.

The system prevents navigators from making potentially critical errors made when they are identifying a situation and when they are planning an anti-collision manoeuvre (80% of collisions occur due to human errors). NAVDEC generates suggested manoeuvres quickly and effectively for many vessels located within a distance from own ship pre-set by the user/navigator. When planning an anti-collision manoeuvre relative to many vessels, the navigator requires much more time, a critical factor for the manoeuvre to be effective. In such situations, developing a manoeuvre that will provide for safe passing distances to a few targets is practically unfeasible.

## The operation of the system

1. Signals identifying own ship and targets (observed by the navigator) are retrieved from navigational systems and equipment.
2. Data contained in received signals are integrated, upon which the system analyzes and assesses the navigational situation.
3. If a vessel faces a risk of collision, the system generates allowable and recommended manoeuvres of own ship or the targets; the manoeuvres, presented to the navigator graphically, are worked out for at least one safety criterion and criteria used in good sea practice, or economical criteria.
4. Once the navigator approves of a solution, one of the allowable or recommended manoeuvres is executed or a series of such manoeuvres.

The system, receiving AIS messages from other ships and ARPA messages from own radar, updates allowable solutions in real time.

## What problem does the system solve?

At present, sea-going ships and yachts do not carry a decision support system to aid them in collision situations, of the type used in aviation (TCAS).

In the Baltic Sea alone the last decade only (2001-2010) witnessed as many as 348 collisions [source HELCOM]. An average cost of ship collision, taking account of the hull repair cost, (excluding the costs of medical care, lost cargo or environmental pollution) is one million USD [source : The Swedish Club]. An average yearly sum of damages paid by insurers (hull and machinery) is about two billion USD [source: The Swedish Club]. An average yearly insurance premium in maritime transport process is 37 billion USD [source IUMI]. Navigational systems presently installed on ships have only an information function. The NAVDEC system processes and integrates data from information systems, and generates anti-collision manoeuvres to be executed. Actions have already been taken at the International Maritime Organization forum, in the NAV Sub-committee in particular, aiming at gradual introduction (advised system – recommended system – mandatory system) of decision support systems on sea-going vessels. Sup4Nav's board members have participated twice at sessions of IMO's sub-committee. As a result of their endeavours, Polish delegation successfully submitted in 2013 a document adopted as NAV 59 INF-2.



**NEW Functionality: Recommended New Course  
as well as a Sector of Safe Courses**

**NEW Functionality: Presentation of our Status according to COLREGs**

**Standard navigational data**

## The product and its development stage

The developed system runs utilizing systems commonly installed on ships and yachts, such as GPS, AIS, or ECDIS – the electronic chart display and information system that enables navigation of the ship, voyage planning and on one screen displays data from navigational equipment (GPS, AIS, ARPA, log, gyrocompass).

The present version of the software does not require additional equipment. Electronic charts for NAVDEC are Jeppesen maps, (signed contract on distribution), such as C-Map Professional Plus.

NAVDEC may operate as a separate system (this requires purchasing charts), or may be incorporated into the integrated navigational bridge system.

## Basic functions of the Navigational Decision Support System NAVDEC:

- automatically acquires, processes and presents navigational information,
- displays a navigational situation in a manner readable to the navigator,
- raises operational awareness of the watchkeeping officer,
- analyzes a navigational situation taking account of the Collision Regulations in force and good sea practices resulting from the experience of many navigators,
- signals dangerous situations,
- solves collision situations by:
  - automatic generation of a manoeuvre conforming to the regulations in force,
  - justifying the proposed manoeuvre.
  - interacts with the navigator.

## Compared to the existing systems, NAVDEC's novel functionalities include:

- generation and display of new courses allowing the ship to pass other targets at a preset distance (see the image),
- presentation of ship's status in the light of the International Collision Regulations, combined with the integrated data from ARPA and AIS (image),
- generation of a solution accounting for a number of vessels in the vicinity (image).

The initial version of the system is presently being demonstrated to shipowners and marketing activities have been undertaken.

We continue research aimed at expanding and supplementing the existing functionalities of the system, following current development trends of such systems and attempting to meet expectations of users on convention and non-convention vessels.

## Unique and innovative features

Compared to ARPA (Automatic Radar and Plotting Aid), a system currently used on ships that calculates ship encounter parameters and thus allows the navigator to work out an anti-collision manoeuvre, NAVDEC has the following advantages:

- takes into account the Collision Regulations for good and poor visibility conditions,
- the generated manoeuvre also accounts for ships that are currently in the blind sector of the radar,
- the operator is immediately notified of a manoeuvre started by another vessel thanks to information on that vessel's rate of turn,
- it requires a few seconds to calculate encounter parameters, while ARPA, according to IMO's (International Maritime Organization) test scenarios, needs as long as three minutes for this procedure,
- the system is more accurate in calculating the encounter distance (distance measured by a radar is 30 m or 1% of its current range scale, whichever value is higher), for two reasons:
  - it allows for ship's length,
  - uses GPS to determine positions and dedicated algorithms carrying out data fusion,
- takes into account ships' sizes while planning an anti-collision manoeuvre,
- for own ship calculates new courses enabling passing other targets at a preset CPA – Closest Point of Approach.

## Target market and its dynamics

### Corporate business segment:

- shipowners of sea-going vessels, who want to enhance the level of safety of their personnel, ships, cargoes and environment in their ships' operations,
- owners/operators of chartered yacht fleets,
- yacht builders,
- producers of navigational equipment, mainly those manufacturing integrated navigational bridge systems (INS),
- producers of electronic chart systems (ECDIS), who may intend to extend a scope of functionalities offered in their system by adding an anti-collision module and thus become more competitive.

### Individual customer segment

- owners of sea- and ocean-going yachts, who want to significantly raise the level of their safety during sea voyages,
- seaman, particularly not experienced, who need a support in daily navigational work.

In 2014 there were more than 81,000 vessels [[www.equasis.org](http://www.equasis.org)] subject to the International Convention on Safety of Life at Sea (SOLAS). All these vessels are equipped with information systems that supply data required for the correct functioning of the NAVDEC system.

On average, the global trade increases yearly by 6%. More than 80% of world's goods are transported by sea. Consequently, the global fleet continues to expand, while an increasingly larger number of ships results in heavier vessel traffic in certain areas, thus a risk of collision becomes higher.

In Europe alone an estimated 6 million leisure motor boats and yachts are in use [[www.icomia.com](http://www.icomia.com)]. The Polish Yachting Association currently has nearly 15,000 registered sea-going yachts.

The global market is much bigger in this respect.

Builders of superyachts will be a priority market, with some 350 superyachts sold yearly. [[www.boatinternational.com](http://www.boatinternational.com)].

## Competition

Direct competitor - Israeli Totem Plus company offering Colregs Advisor. The product from Totem Plus is being tested on vessels and offered as an addition to other solutions of that manufacturer, not sold commercially.

## Revenue model

- Sale of 'wholesale' licences for shipowners, as well as individuals (sailors and seaman),
- Implementation of the component/software library as an additional functionality of the existing systems (mainly INS and ECDIS),
- NAVDEC as a navigation system for yacht.

NAVDEC as a software sold with or without hardware.

NAVDEC (in the form of a library, software component) will be sold under a foreign brand, and a unit cost of the licence will depend on the number of licences sold in a settlement period (under 100, under 500, over 500, or unlimited quantity licence). The licence does not include possible system upgrades, but entitles to a discount on the latest version.

NAVDEC as an independent navigation system for yacht with standard functionality of chartplotter and anticollision module.

- Advertising in yachting magazines, including free of charge articles.
- Contact with navigational equipment distributors for sailors, contract for distribution signed with the company Inwestycje CM SL based in Spain.
- Establishing co-operation with companies dealing with navigational software and equipment (INS and ECDIS) – contacts mainly through the representative in Germany (main maritime market in Europe, one of the largest worldwide), Scapos AG,
- Establishing co-operation with yacht builders and companies which equip yachts with electronic.



## Sales strategy

- Direct contact with shipowners,
- Reach retail customers through our website [www.navdec.com](http://www.navdec.com), advertising in magazines and sailing related portals.
- Presentation of the product at maritime and yacht fairs.

## Founders and management board:

**Piotr Wołejśza, PhD, Eng., Master Mariner** – President of the Board, navigator by education, served on ships for a total of 15 years, he climbed all the steps of the seafarer's career, from an ordinary seaman to captain. Has long experience working in officer positions. Winner of Szczecin's President award for the best doctoral technology-related dissertation (Multi-agent system of navigational decision process support). Graduate of TOP 500 Innovators program (Science, Management, Commercialization), Stanford University. In charge of the Board, he is responsible for contacts with shipowners (e.g. Polish Steamship Company, Unity Line), co-operation with producers of navigational equipment for convention vessels (FURUNO, Jeppesen, SAM Electronic, others) and supervision of sales representatives operating on the ECDIS market (Scapos).

**Zbigniew Pietrzykowski, DSc, Eng.** – Member of the Board, head of the research team, Vice Dean for Science, Navigation Faculty, over 30 year employment at the Maritime University of Szczecin. Awarded with 'West Pomeranian Nobel' in Marine Sciences 2009. Member of Transport Traffic Control Unit, Committee on Transport, Polish Academy of Sciences, Polish Safety and Reliability Association, Polish Association of Transport Telematics, Polish Navigational Forum, Technical Council of the Polish Register of Shipping S.A.. At Sup4Nav, in charge of research, development of the system and its functionalities, and certification of the system in classification societies, Polish Register of Shipping and RINA.

**Piotr Borkowski, DPh** – Member of the Board, computer scientist specializing in computational mathematics applications, including artificial intelligence methods, and selected problems of marine navigation. Director of the Institute of Marine Technologies, Maritime University of Szczecin. On the Board, responsible for contacts with sea yacht owners and their associations (e.g. Polish Yacht Cluster Foundation), co-operation with sea yacht builders and yacht navigational equipment makers (Garmin, Galeon, Northman, Eljach, others) and supervision of sales representatives operating on the yacht navigational equipment market.



Piotr Wołejśza, Ph.D., Master Mariner, Professor Zbigniew Pietrzykowski, Piotr Borkowski Ph.D.

**Tomasz Łasecki** – Proxy. Manager for Investment Projects at the Polish Entrepreneurs Foundation, has 10 year experience in technology commercialization, member of the team managing the Pomeranus SEED Fund, manages the AMBER Business Angels Network. Marine yacht helmsman.

## Awards

- Sup4Nav LLC has been distinguished by Szczecin's President as an Innovation of the Year in the Business Awards – Business Compass 2013 competition.
- NAVDEC made it to the final seven in IT sector of the programme "Polish Invention of the Year 2014" co-organized by the Ministry of Science and Higher Education and Polish TV.
- Sup4Nav has taken 2nd place (Polish regional competition) in EUROPEAN SATELLITE NAVIGATION COMPETITION 2014 and was 2nd in University Challenge.
- Sup4Nav has been distinguished by Newsweek Polska and PwC in category StartUp of the Year 2015.

## Intellectual property protection

„A method and system of navigational decision support in the process of safe vessel navigation” Patent Application PCT nr PCT/PL2010/000112, 08-11-2010r. Patent Application - European Patent Office (EPO): A method and system of navigational decision support in the process of safe vessel navigation, Pietrzykowski Z, Wołejszka P, Magaj J, Borkowski P, Chomski J, Uriasz J, Dziedzic T, Mąka M, Kazimierski W, Szewczuk T, Wielgosz M.

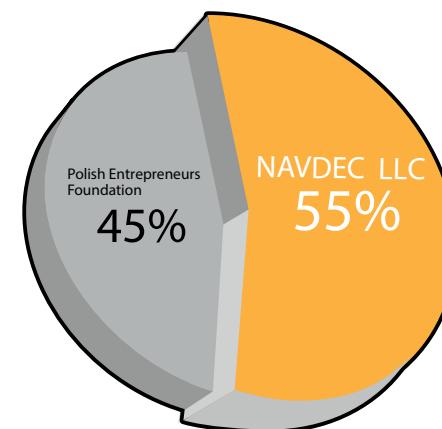
The application was accepted by the Office which published it in 2011. To date, the inventors have not received any official information on possible acceptance, rejection or need to modify the application.

Since in Europe software cannot be patented, the inventors submitted the method of decision support. The patented method embodies experts' knowledge in navigation (three inventors hold marine diplomas of Master Mariner), computer science – decision support systems, electronics – data transmission protocols, mathematics – algorithms for data fusion and integration. The multidisciplinary team, with their extensive practical experience, was able to create a comprehensive decision support system for sea-going vessels.

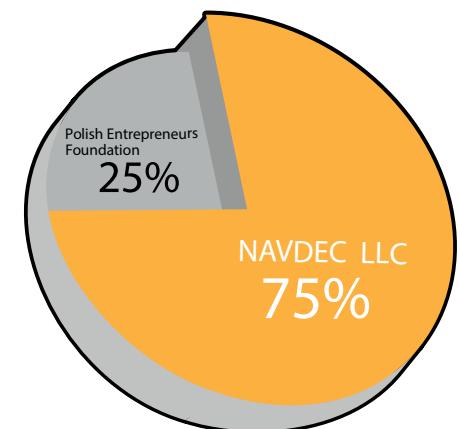
## Projected investment amount and allocation

500.000 euro as own contribution to SME Instrument Phase II. This enables a further 1 million EUR EU grant for development of other functionalities of the system, first of all:

- mobile application for Android and iOS,
- reading from maps e.g. information about shoreline, depth of the water, etc,
- drawing of real-time trajectory how the ship should be steered,
- integration with open source map like Open Sea Map,
- automatic communication between ships using the system,
- last minute manoeuvre (when ships are at a distance to each other that a manoeuvre of one ship only will not be enough to safely pass the other, and to avoid a collision both ships have to make synchronized manoeuvres);
- extension of already planned sales activities, broadening of the planned sales network - creation of a marketing and service department, promotional activities, presence at trade fairs, advertising in dedicated journals, business meetings with prospective contractors, building of servicing and sales network in Europe, Asia and the USA.



At company establishment



Upon reaching milestones