Investigating maritime accidents

There are multiple reasons for carrying out accident investigations, but the primary reason is often a need to gain a deeper understanding of the course of the events from both a human and technical perspective. From this analysis, conclusions can be made that may result in recommendations for decreasing the risk of a similar accidents occurring. SSPA regularly conduct accident investigations for our clients, covering a range of accident types and factors such as running aground, collisions, ship stability and seakeeping issues, oil spills and structural issues. This article briefly describes how SSPA assisted with an investigation of the tragic accident that occurred at the Port of Genoa, Italy in May 2013. A ship backed into a port control tower, causing it to collapse and killing nine people. By simulating the accident and running alternative scenarios, SSPA were able to give our clients thorough understanding of the events as well as important documentation to use in the legal process.

Many of our maritime regulative instruments are a result of improvements after major accidents. Learning from accidents is valuable in many aspects, from helping to implement on-board operational procedures to creating new or developing existing regulations. SSPA's expertise in hydrodynamics, manoeuvring and seakeeping simulations, model testing, computational fluid dynamics, structural computation, measurement techniques, signal processing, risk assessment and human factors, and knowledge of ship operations, puts us in a unique position to grasp the overall complexity of accident investigation and analysis. From this analysis, conclusions can be made that may result in recommendations for decreasing the risk of a similar accident occurring in the future.

Generalised data flow diagram

The introduction of recording devices, e.g. VDR, logging of AIS data and logging of weather and hydrographic-related data has dramatically changed the ability to reconstruct and investigate accidents in the last decade.

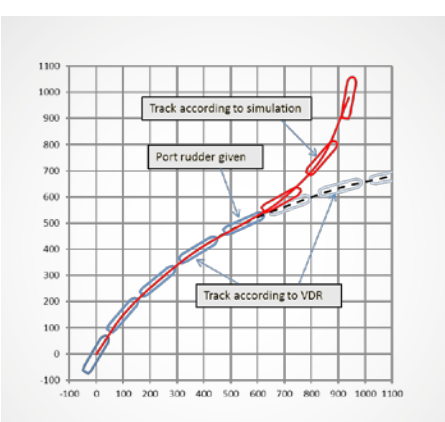
Today we usually have access to one or more of these data sources to reconstruct scenarios and to validate models for simulations of alternative scenarios.

The generalised data flow diagram shown here uses the typical sources of data indicated. The data from all these sources is compiled in a database with a common timeframe. This ensures that all data is well defined and synchronised throughout the analysed timespan.

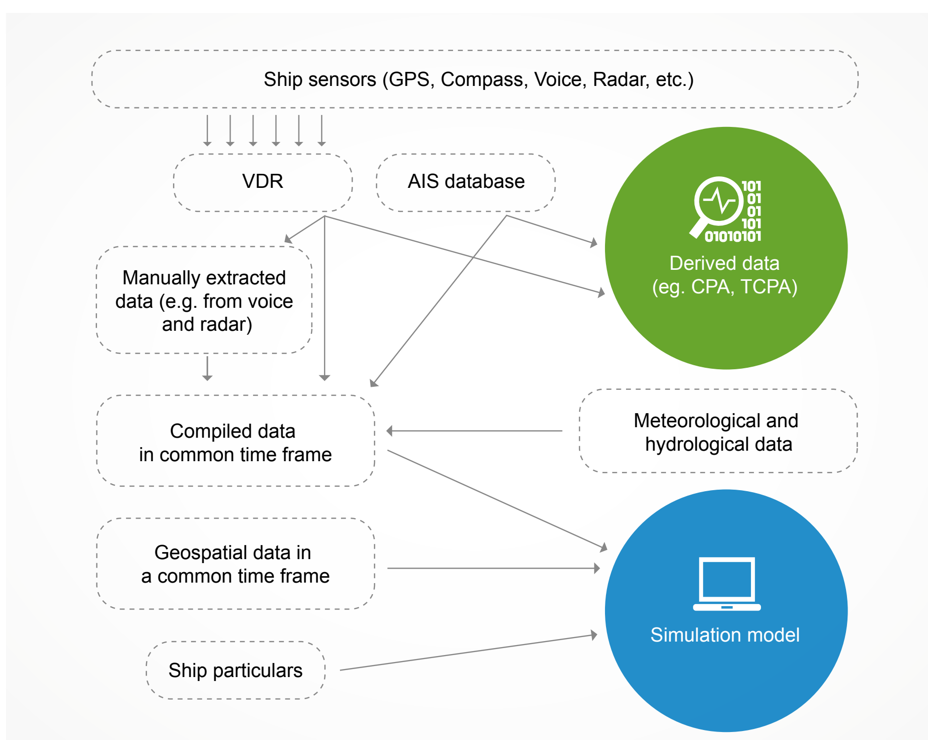
Forming the simulation system

It is always important to identify the flow of communication and sequence of events during accident investigations. The digitisation of some parts of the data extracted from the voice recording sources and radar images is therefore often relevant. What and when certain information was received and orders were given can be identified using voice data.

Radar images can be used to determine when actions such as initiating plotting of a radar target or a change of range were taken.



VDR data is used initially. When a manoeuvring device is used, the system switches to simulation mode. Figure: SSPA.



Utilisation of data sources in simulations for the various sources that form the basis of the simulation system. Illustration: SSPA.

Important derived data can be calculated by combining the data sources, e.g. CPA (Closet Point of Approach), TCPA (Time to CPA), distances to targets and geospatial data (e.g. depth contours of interest).

The simulation technique developed by SSPA permits the running of seamless scenarios generated using recorded data (e.g. from VDR), and the option of switching over to simulation at any given moment is a very useful tool for investigating the incident itself as well as elaborating on alternative action that could have been taken.

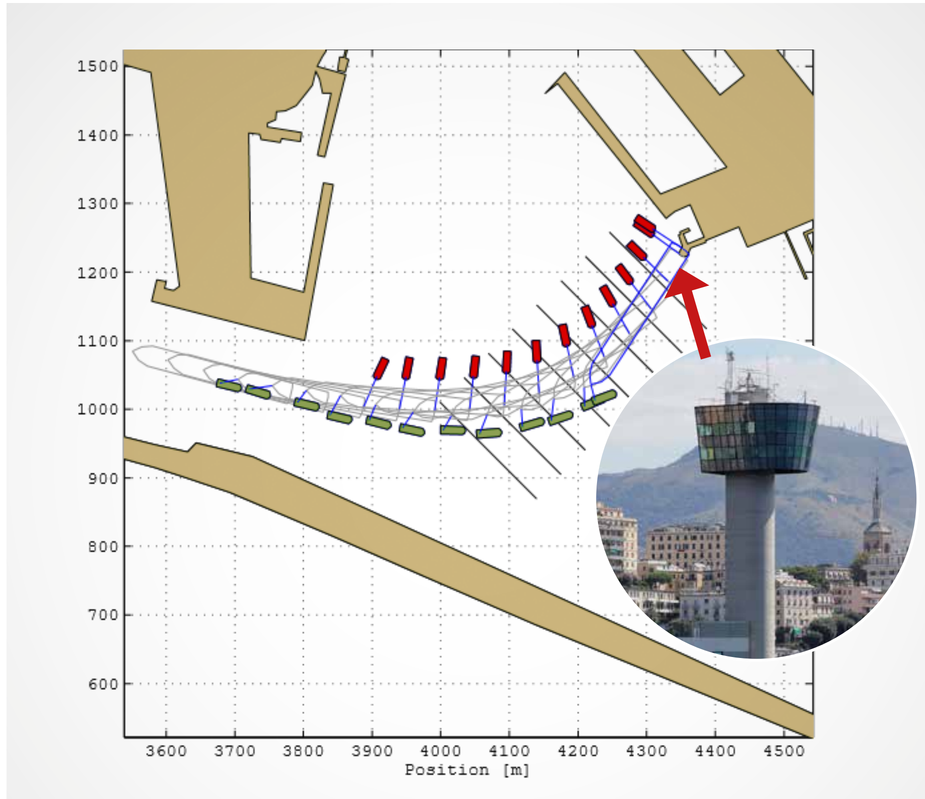
The real-time manoeuvring and seakeeping software SEAMAN is an extremely competent software for analysing situations when it comes to confined water phenomena, ship interaction and seakeeping.

The Jolly Nero accident

On the evening of 7 May 2013, the container/ro-ro ship Jolly Nero backed into the 50-metre port control tower at the Port of Genoa, causing it to collapse, and killing nine people. Assisted by two tugs – Genua at the bow and Spagna at the stern – Jolly Nero had completed a more than two-nautical-mile-long stern manoeuvre from the Messina Terminal to the turning basin at the eastern exit of the port.

When the ship was in the middle of the turning basin, its pilot ordered engine ahead. The attempt to start the engine were unsuccessful, and during the elapsed time of uncertainty regarding the engine status, ship came so close to the control tower that evasive actions became ineffective.

SSPA was contracted by Studio Tecnico Navale Ansaldo, Genoa, Italy, to carry out an investigation in order to reconstruct the course of events during the the final manoeuvres that led to the collision, and to assess alternative scenarios. Studio Tecnico Navale Ansaldo was commissioned by the juridical defence for the pilot in charge.



The reconstructed track of the Jolly Nero and the tug prior to the collision with the control tower. The stern and bow tug is indicated in red and green respectively. Illustration: SSPA.

The reconstruction of the accident

The data from the VDR of Jolly Nero was extracted, as was the AIS data of the bow tug Genoa. The tug Spagna was not equipped with an AIS transponder, so its position had to be estimated based on information from the client.

A mathematical model of the ship dynamics of Jolly Nero was developed. The development was based on available data such as pilot card and model tests with similar ships. The two tugs, Spagna and Genoa, that assisted Jolly Nero at the time of the accident were also modelled.

For validation of the models, SSPA's experts used results from sea trials carried out after the accident. The trials included:

- Stopping from 3 knots astern speed using various ahead manoeuvres
- Turning test at 3 knots astern speed using tugs (this manoeuvre is similar to the manoeuvre carried out prior to the accident)

By running these simulations, it was possible to estimate the forces and position of the tugs. The simulation of alternative scenarios gave insight into the required timing and margins for avoiding collision with the control tower.

In the autumn of 2016, SSPA's experts gave testimony of the investigation and its findings at the court hearings in Genoa.

SEAMAN SIMULATION

Simulations can be run to gain valuable insight to support decision-making and provide solutions to complex problems. For each simulation assignment, SSPA communicates with the client to ensure that the simulation has the right level of detail with regard to both accuracy and cost-efficiency. To ensure the appropriate level, there are a number of areas that SSPA will tailor to the client's needs: Ship Dynamics, Modelling, Instrumentation, Visualisation and Analysis.

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