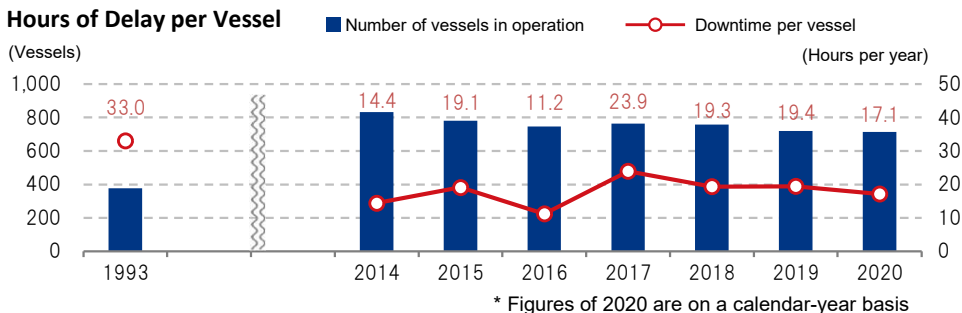## PLAN

Safety promotion system

Each year, the Safety and Environmental Management Committee, chaired by the president reviews activities for the previous year and sets targets and guidelines for the next year.

Safety and Environmental Management Committee
Chair: President

- Safety Promotion Headquarters
  - Safety Steering Committee
- Environmental Management Headquarters
  - Environmental Steering Committee

Regional and Sub-organizations

N-MEC Technology Committee
Administers the education, training, and development of crew members

Regional SEMCs
- East Asia
- South Asia
- Europe
- North America

Committees by Ship Types
Containership/car carrier/ tanker/liquid gas carrier/ dry bulker/cruise ship

Committees by Task
Save Bunker Committee, etc.

Using downtime to measure safety

We use the time that ships are stopped due to accidents or problems as an indicator to measure the degree to which we have achieved safe ship operations. Our sea and land operations work together to bring us closer to the target of zero downtime.

Hours of Delay per Vessel

■ Number of vessels in operation   ─○─ Downtime per vessel

(Vessels) / (Hours per year)

Year	1993	2014	2015	2016	2017	2018	2019	2020
Downtime per vessel	33.0	14.4	19.1	11.2	23.9	19.3	19.4	17.1

* Figures of 2020 are on a calendar-year basis

Emergency response network

We have created an emergency response network*1 to be prepared for maritime accidents and problems no matter where they occur in the world.

DO

Safety campaigns

Every year, we conduct the Remember Naka-no- Se*2 safety campaign in the summer and the Sail on Safety*3 campaign in the winter.
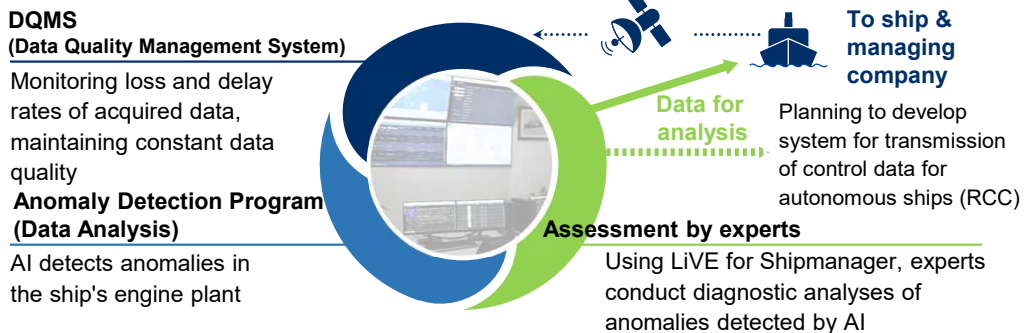
Near Miss 3000 activities

Inspired by Heinrich's Law*4, we conduct Near Miss 3000 activities on board our ships as a proactive program to prevent accidents before they occur. We have developed this program from a near-miss level to create what we call DEVIL Hunting activities that seek to eliminate accidents by identifying and addressing situations that are precursors to often overlooked problems. Further, we expanded the scope of the program to cover the entire NYK Group in 2006, and it also covers our partner shipowners and ship-management companies.

- 1 — Major accident
- 29 — Minor accidents or troubles
- 300 — Near misses

Heinrich's Law

3,000... Unsafe conditions / Unsafe acts = **DEVIL**
Dangerous **EV**ents and **I**rregular **L**ooks

Number of DEVIL Hunting Reported

* Figures of 2020 are on a calendar-year basis

FY2017	FY2018	FY2019	CY2020
71,160	70,009	58,915	62,887

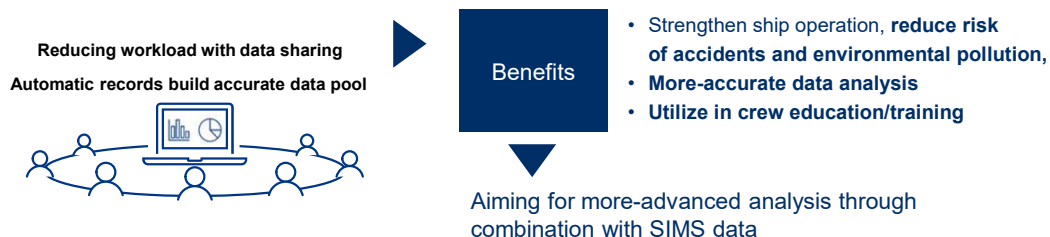### Establishing the Remote Diagnostic Center: "Expert in the Loop"

Expert navigation officers and engineers analyze accuracy and importance of the data based on anomaly detection system and take necessary actions including explanation to customers

DQMS (Data Quality Management System)
Monitoring loss and delay rates of acquired data, maintaining constant data quality

Anomaly Detection Program (Data Analysis)
AI detects anomalies in the ship's engine plant

Assessment by experts
Using LiVE for Shipmanager, experts conduct diagnostic analyses of anomalies detected by AI

Data for analysis

To ship & managing company
Planning to develop system for transmission of control data for autonomous ships (RCC)

*1 **Emergency Response Network :** Our emergency response network divides the world into four regions. This enables us to respond quickly and minimize damage in the event of any accident or problem anywhere on the seas.
*2 *Remember Naka-no-Se* **Campaign :** We conduct this campaign every July, the month in which an oil spill occurred from the very large crude oil carrier Diamond Grace at Naka-no-Se in Tokyo Bay in 1997, to ensure that the lessons from the spill are not lost.
*3 *Sail on Safety* **Campaign :** We conduct this campaign over the winter months of December and January with a primary focus on rough weather safety.
*4 **Heinrich's Law :** A formula regarding work-related accidents stating that there are 29 minor accidents and 300 near misses behind every major accident.

DO

NiBiKi (Shipmanagement Platform)

Developed a system for managing daily ship operations to analyze data from numerous angles and provide visualized results. Rolled out to all ships for use in November 2019. As of FY2020, in use by approx. 260 ships and 7 management companies. The data collected by the system plans to be utilized efficiently for safety operation.

Reducing workload with data sharing

Automatic records build accurate data pool

Benefits
- Strengthen ship operation, **reduce risk of accidents and environmental pollution,**
- **More-accurate data analysis**
- **Utilize in crew education/training**

Aiming for more-advanced analysis through combination with SIMS data

APExS（Action Planning and Execution System）

30 years of ship operation data × **Experience-based algorithm**

Research underway
- **Automatic collision avoidance functions** to reduce accidents
- **Support from onshore facility**
- **Remote operation in emergencies**

Aiming to realize the operation of manned autonomous ship from onshore facility (RCC : Remote Control Center)

CHECK

NAV9000

NAV 9000

In 1998, the NYK Group introduced NAV9000, which is a rigorous, self-imposed ship safety management system, in order to fulfil our responsibilities in terms of safety and environmental protection. This system requires ships, shipowners, and ship management companies to disclose information on safe ship operations and adhere to NYK standards for both ships we own and chartered vessels.

Due to Covid-19, e-Audit has been conducted in 2020 to maintain our activities.

Breakdown of NAV9000 Audits

* Figures of 2020 are on a calendar-year basis

	FY2017	FY2018	FY2019	CY2020
Ship audits	287	239	204	67
Company audits	30	26	14	4

*5 Safety Bulletins : We publish a safety information journal to raise awareness and issue instructions to the entire fleet on piracy, terrorism, and other matters of concern in voyages as well as causes of accidents and problems and prevention measures.

ACT

Identification of causes and improvements toward achieving our objectives

We use information on accidents in order to prevent their recurrence. We notify the fleet immediately when accidents occur, and follow up through means including safety bulletins*5 that issue instructions to prevent recurrence once we have identified the causes and formulated countermeasures. Furthermore, NAV9000 inspections require ships, ship owners, and ship management companies to make improvements so that they can continue to operate vessels safely.

Advancements in Digitalization (Safety)

In addition to upgrades of LiVE for Shipmanager (ship engine plant monitoring app using big data), we developed a Data Quality Management System, which monitors the quality of logic and data related to trouble detection in engine operating data. Leveraging these technologies, enable to find signs of engine troubles automatically before happen, and leads to engine trouble preventions.
We are also engaged in cyber security to be prepared for the digitalized operation in the future. One keyword of the NYK Group medium-term management plan is Digitalization. We aim to enhance the safety levels and seek even safer navigation.

Commutating & standardization of ship data

Integration/sharing/analysis

- SIMS
- NiBiKi
- IBIS
- RDC
  - DQMS
  - Anomaly detection program
- ROSE

Intensifying the utilization of ship performance monitoring

Development a user-friendly database

Advancing analytic methods & technologies

Data collection

Utilizing to improve ships/operations