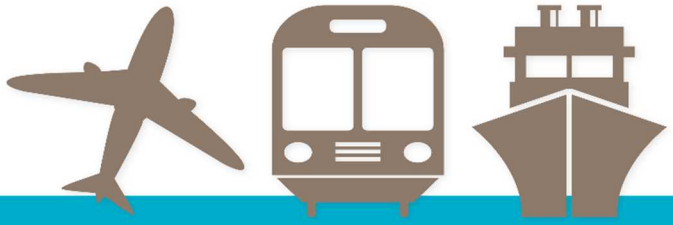
Japan Transport Safety Board
Annual Report 2019



ANNUAL REPORT 2019

July, 2019

Japan Transport Safety Board

JTSB Mission

We contribute to

- preventing the occurrence of accidents and
- mitigating the damage caused by them,

thus improving transport safety while raising public awareness, and thereby protecting the people's lives by

- accomplishing appropriate accident investigations which thoroughly unveil the causes of accidents and damages incidental to them, and
- urging the implementation of necessary policies and measures through the issuance of safety recommendations and opinions or provision of safety information.

JTSB Principles

1 Conduct of appropriate accident investigations

We conduct scientific and objective accident investigations separated from apportioning blame and liability, while deeply exploring into the background of the accidents, including the organizational factors, and produce reports with speed. At the same time, we ensure that the reports are clear and easy to understand and we make efforts to deliver information for better understanding.

2 Timely and appropriate feedback

In order to contribute to the prevention of accidents and mitigation of the damage caused by them, we send messages timely and proactively in the forms of recommendations, opinions or factual information notices nationally and internationally. At the same time, we make efforts towards disclosing information in view of ensuring the transparency of accident investigations.

3 Consideration for victims

We think of the feelings of victims and their families, or the bereaved appropriately, and provide them with information regarding the accident investigations in a timely and appropriate manner, and respond to their voices sincerely as well.

4 Strengthening the foundation of our organization

We take every opportunity to develop the skills of our staff, including their comprehensive understanding of investigation methods, and create an environment where we can exchange opinions freely and work as a team to invigorate our organization as a whole.

Greetings from New Chairperson

It is my honor to be appointed as the Chairperson of the Japan Transport Safety Board (JTSB). I deeply feel the great responsibility of JTSB which plays an important role in Japanese transportation safety from a fair and neutral standpoint to prevent aircraft, railway and marine accidents and incidents and also mitigate the damage caused by them.

I have long believed in our Japanese transportation safety technology. I am proud of the high spirits and continuing efforts of our predecessors to have kept our Japanese transportation safety. But we have recently been experiencing some serious accidents and incidents which might threaten our Japanese transportation safety. We need to keep improving our capability for investigation of aircraft, railway and marine accidents and incidents.

Our JTSB mission says as follows: “We contribute to (1) preventing the occurrence of accidents and (2) mitigating the damage caused by them, thus improving transportation safety while raising public awareness, and thereby protecting the people’s lives by (1) accomplishing appropriate accident investigations which thoroughly unveil the causes of accidents and damages incidental to them, and (2) urging the implementation of necessary policies and measures through the issuance of safety recommendations and opinions or provision of safety information”.

Although we need to rely on and fully make use of lessons learned during previous investigations on many accidents and incidents, we always must keep improving our transportation safety technology in appropriate scientific and objective manners since we have seen more situations where previous investigation procedures cannot be applied in the same manner as in the past. It is also important to think of the feelings of victims and their

families, or the bereaved appropriately, and provide them with information regarding the accident investigations in a timely and appropriate manner, and respond to their voices sincerely as well.

Our JTSB consists of 1 chairperson and 12 members (7 full-time and 5 part-time) with accident and incident investigators in aircraft (25), railway (19) and marine (23) transportation modes as well as 42 regional investigators. The JTSB is also strongly supported by our administrative staff dealing with international affairs and public relations.

We all are very proud to be members of the JTSB and try to improve our ability in transportation safety investigations. Although each transportation mode (aircraft, railway and marine) has its own features in accidents and incidents, we need to keep discussing with each other for common issues such as human errors and new equipment by cutting-edge technologies to share our common solutions for transportation safety.

Your understanding, support and cooperation would be highly appreciated.

TAKEDA Nobuo
Chairperson
Japan Transport Safety Board
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Feature 1: Partial revision of the Act for Establishment of the Japan Transport Safety Board

1. Background of the partial revision of the Act for Establishment of the Japan Transport Safety Board

Japan's first passenger jet, which is currently in development by Mitsubishi Aircraft Corporation, is slated to enter service in the middle of 2020. As the service begins, Japan will become a State of Aircraft Design pursuant to the Convention on International Civil Aviation. As a State of Aircraft Design, Japan is expected to meet the standards in the field of aircraft accident investigation and will need to implement appropriate accident and serious incident investigations. Accordingly, the Act for Establishment of the Japan Transport Safety Board (hereinafter referred to as "Establishment Act") has recently been revised as needed through the enactment of the Act Partially Amending the Civil Aeronautics Act and the Act for Establishment of the Japan Transport Safety Board (Act No. 38 of 2019).

2. Main points of the revision

(1) Expanding the range of reportable matters concerning aircraft accidents and serious incident by the Minister of Land, Infrastructure, Transport and Tourism

When an aircraft accident or serious incident has occurred, it is important to respond in a timely and appropriate manner by interviewing and obtaining relevant information from the persons concerned, inspecting the site as part of the initial investigation, and taking other required measures as soon as possible. To this end, a legal revision has recently been made, newly requiring the Minister of Land, Infrastructure, Transport and Tourism to immediately notify the Japan Transport Safety Board (JTSB) if someone who received a type certificate of a particular aircraft has collected defect information including accidents or serious incidents involving the same aircraft model and reported it to the Minister of Land, Infrastructure, Transport and Tourism. This is an addition to an already enforced requirement of immediate notification in cases where the Minister of Land, Infrastructure, Transport and Tourism has received a report of an aircraft accident or serious incident from the pilot of the aircraft concerned or learned of an aircraft accident otherwise. Through this measure, the JTSB will be able to obtain the latest information including that on "aircraft serious incidents" from domestic aircraft manufacturers and thereby take fast and reliable initial action when investigating an accident or serious incident.

(2) Expanding the scope of "aircraft serious incidents"

Under the Establishment Act prior to the revision, "aircraft serious incidents" to be investigated were limited to situations which occurred during an aircraft flight based on understanding in accordance with the Convention on International Civil Aviation. In recent years, however, incidents deemed to have been caused by the design of aircraft have arisen in other states, e.g., a fire starting in the equipment of an aircraft which is parked and not in the air.

As cases such as this would suggest the possibility of aircraft accidents if they happened during a flight, they are subject to investigation in the US and other major States of Aircraft Design with a view

to ensuring the safety of aircraft designed and manufactured on their soil. As Japan needs to fulfill its responsibility concerning the safe navigation of domestically built aircraft when it becomes a State of Aircraft Design, the recent revision was made to ensure that Japan could respond responsibly to requests from states where an incident has occurred by including situations such as a fire in the equipment of a parked aircraft as matters to be investigated.

(3) Clarification of parties subject to order for reports

The Establishment Act prior to the revision provided for the JTSB taking the dispositions when it finds it necessary to conduct the investigation of an accident or serious incident, such as taking reports from the parties concerned with the accident, conducting on-the-spot inspections of the accident site and questioning the parties concerned.

Through the recent revision of the Establishment Act, "aircraft designer, etc." (a person who designs, manufactures, services, remodels or inspects an aircraft or its equipment or parts) has been listed as one of the parties subject to such dispositions. Accordingly, "aircraft designer, etc." has been clearly defined in laws and the JTSB will definitely be able to take reports from aircraft manufacturers and parts manufacturers.

(4) Issuance of recommendations prior to the completion of investigation

Under the Establishment Act prior to the revision, the JTSB was allowed to make recommendations to the Minister of Land, Infrastructure, Transport and Tourism and the parties relevant to the cause on measures to be taken to prevent accidents and to reduce damage if such accidents occur at the completion of the investigation of an accident or serious incident based on the results of the investigation.

If an accident or serious incident involving a domestically built aircraft occurs in the future, matters to be investigated will increase more than ever before and investigations may take longer as Japan needs to fulfill its responsibility as a State of Aircraft Design. As well, to ensure the safety of the same aircraft model, safety measures must be quickly implemented before the investigation is completed.

The recent revision of the Establishment Act has enabled the JTSB to issue necessary recommendations to the Minister of Land, Infrastructure, Transport and Tourism and the parties relevant to the cause even before the completion of investigations based on the latest findings. With timely recommendations, greater effectiveness is expected.

Through the revision of the Establishment Act, the JTSB will be able to make recommendations prior to the completion of investigations not only in aircraft accidents and serious incident but also marine and railway accidents/serious incidents.

(5) Implementation of investigation commissioned by other states where an accident or serious incident has occurred (specific investigation)

Should there be an accident or a serious incident overseas involving a domestically built passenger jet, the State where the accident or serious incident occurred (the State of Occurrence) would need to conduct an investigation in accordance with the Convention on International Civil Aviation while Japan,

as the State of Aircraft Design, would also participate in the investigation conducted by the State of occurrence, as the relevant States (the State of Design, the State of Manufacture, the State of Operator, and the State of Registry)[1] have rights to do so. In addition, as the State of Occurrence is allowed to commission all or part of the investigation to the relevant states subject to an agreement with them, it is possible that Japan, as the State of Aircraft Design, will be commissioned by the State of Occurrence to conduct a detailed investigation on the design and manufacture of the domestically built passenger jet.

"Specific investigation" newly established by the recent revision of the Establishment Act refers to a detailed investigation on designing and manufacturing of a domestically built passenger jet conducted by Japan as the State of Aircraft Design, commissioned by a State of Occurrence. According to the Convention on International Civil Aviation, a State of Aircraft Design commissioned to conduct an investigation by a State of Occurrence is not allowed to release the results of any investigation without the consent of the State of Occurrence before the State of Occurrence completes its investigation and releases a report. Accordingly, the revision of the Establishment Act provides that in case of a "specific investigation," the JTSB shall notify the Minister of Land, Infrastructure, Transport and Tourism and publicize the investigation results when the State of Occurrence has released a report after completing its investigation, not when an investigation is completed in Japan.

3. Concerning efforts after the revision of the Establishment Act

In anticipation of the service launch of a domestically built passenger jet in 2020, the JTSB needs to fully prepare a system to respond to requests for detailed investigations on designing and manufacturing of domestically built passenger jets as Japan becomes a State of Aircraft Design.

When it comes to the development of the system, "improvement of investigation skills" and "enhancement of cooperation with overseas accident investigation authorities" are especially important.

To improve investigation skills, the JTSB needs to enhance skills to deal with the important new factor, namely, "design." For this reason, the JTSB plans to establish an accident investigation system appropriate for a State of Aircraft Design by developing human resources through the enhancement of education and training concerning design concepts, operation, maintenance service, etc. of domestically built passenger jets. More specifically, in cooperation with aircraft manufacturers and research institutions, the JTSB will set up various opportunities: training for operating domestically built passenger jets by using a simulator, classroom lecture concerning design concepts, etc. by engineers from manufacturers and academics, and education concerning design and manufacture including inspection of actual aircraft and maintenance training.

As for the enhancement of cooperation with overseas accident investigation authorities, we have to build up "personal day-to-day relationships" with them in advance so we could immediately start working

[1] "State of Design" refers to a State which has jurisdiction over the organization responsible for type design, "State of Manufacture" refers to a state which has jurisdiction over the organization responsible for final aircraft assembly, "State of Operator" refers to a state where the operator's activities are primarily located, or in cases where the operator does not have such a place, where the operator's address is, and "State of registry" refers to a state where the aircraft has been registered.

with them when an accident or serious incident occurs. When we visited France in October 2018, the State of Airbus-Design, and exchanged opinions with officials of the BEA, the accident investigation authority of the State, concerning what is required as an State of Aircraft Design, the Secretary General of the organization suggested that States of Aircraft Design should keep in close touch with accident investigation suthorities of States of Registry, States of Operator and states under the flight paths of aircraft made in the States of Aircraft Design on a regular basis by exchanging email addresses and mobile phone numbers. Accordingly, we are doing our own preparation.

Since it foundation, the JTSB has released accident investigation reports for 279 cases of aircraft accidents and serious incident, and tracked down the causes of accidents while making proposals for developing safety measures and policies through issuing recommendations to the Minister of Land, Infrastructure, Transport and Tourism and the parties relevant to the cause and safety recommendations, etc. to overseas authorities.

By fully taking into account the details of the recent revision of the Establishment Act, the JTSB declares that it will improve investigation skills concerning domestically built passenger jets and enhance international cooperation as appropriate for an State of Aircraft Design, and that it will fulfill its important roles in ensuring the aviation safety by conducting accident and serious incident investigations in a timely and appropriate manner and making recommendations for the prevention of recurrence as a fair and neutral accident investigation authority.

In addition, the JTSB aims to promote the conclusion of a memorandum of bilateral cooperation concerning accident and serious incident investigations with States of Registry, States of Operator, etc. in light of states and regions where domestically built passenger jets will enter service. At the same time, the JTSB will develop a scheme through which accident investigators could mutually improve their investigation skills.

(Reference) States where passenger jets used by Japan's airlines were designed and manufactured

State of Design and Manufacture	Designer/manufacturer	Representative models
US	Boeing	B787, B777, B767, B737
France	Airbus	A380, A350, A320
Canada	Bombardier	CRJ700, CRJ200
Brazil	Embraer	ERJ190, ERJ170

Appropriate implementation of accident and serious incident investigation by the JTSB

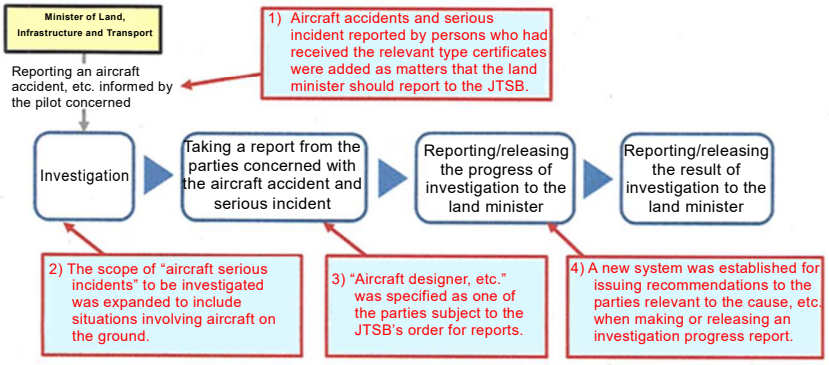
1. Revision of the Act for Establishment of the Japan Transport Safety Board

As **Japan needs to fulfill its roles as a State of Aircraft Design and Manufacture** in accordance with the Convention on International Civil Aviation when a domestically built aircraft enters service in 2020, **the Act for Establishment of the Japan Transport Safety Board shall be revised as required.**

2. Outline of the legal revision

1) The revised Civil Aeronautics Act provides that the Minister of Land, Infrastructure, Transport and Tourism shall **immediately notify the Japan Transport Safety Board (JTSB)** if the minister of Land, Infrastructure, Transport and Tourism has received **a report** from someone who received a type certificate of an aircraft model **when an accident or serious incident involving the particular aircraft model occurs.**
2) **The scope of "aircraft serious incidents"** subject to investigation by the JTSB **was expanded to include situations involving aircraft on the ground.**
3) **"Aircraft designer, etc."** was specified as one of the parties **subject to the JTSB's order for reports**
4) A new system was established to enable the JTSB to issue **necessary recommendations to the parties relevant to the cause, etc. when making or releasing an investigation progress report**, in anticipation of cases where safety must be promptly ensured in response to aircraft accidents or serious incident concerning domestically built aircraft.

(Reference) The accident and serious incident investigation flow and the legal revision summary



* Reference case (related to 2) above)

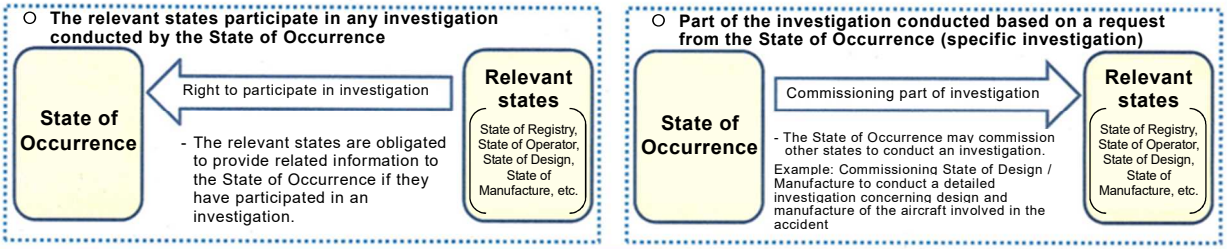
- In January 2013, a fire started in the APU battery (the battery for the auxiliary power unit) of a parked Boeing 787-8 of Japan Airlines in Boston's Logan International Airport in the US and burned the surrounding part.
- In response, the National Transportation Safety Board (NTSB), the accident investigative body of the US, conducted an investigation as a case of an aircraft serious incident.

The aircraft at the time of the fire and the damaged battery

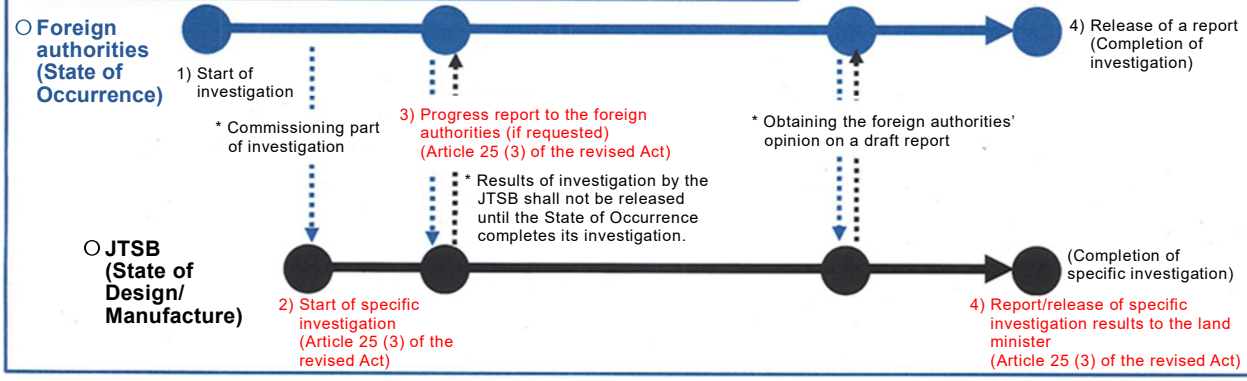
The framework of accident and serious incident investigation pursuant to the Convention on International Civil Aviation and States of Design/Manufacture's responsibilities

The framework of accident investigation pursuant to the Convention on International Civil Aviation

According to the Convention on International Civil Aviation, in case of an aircraft accident or serious incident, the State where the accident or incident concerned occurred (the State of Occurrence) shall start an investigation.



Cases of part of investigation conducted based on a request from the State of Occurrence (specific investigation)



Feature 2: 10th anniversary of Japan Transport Safety Board — Future Direction of Priority Activities

Direction of Our Focused Commitments with an Eye toward the Next 10 Years

In October 2008, the Japan Transport Safety Board was set up based on Article 3 of the National Government Organization Act as a more independent accident investigation authority that was assigned the authority to investigate marine accidents in addition to aircraft and railway accidents, which had been investigated by the Aircraft and Railway Accidents Investigation Commission; the authority to make recommendations to parties concerned with causes as well as administrative agencies; and extended authorities to, for example, provide information to victims and their families or families of those who lost their lives in accidents.

Since being setup, the board has been working to help prevent accidents and reducing damage by investigating aircraft, railway, marine accidents and incidents and tracking down the causes of them to the last extremity and by requesting parties concerned to take necessary measures and/or actions through communication of recommendations and suggestions.

With its missions and an action guideline declared in March 2012 as indicated on the first page of this annual report, the Japan Transport Safety Board has got down to conducting scientific and objective investigations while paying attention to organizational problems and other backgrounds of accidents and incidents, as well as, for prompt announcements that are easy to understand, improving the investigation manuals on a per transport mode (aircraft, railway, or marine), improving the description, shortening the time for translating accident or serious incident investigation reports, and applying special formats.

Having marked its 10th anniversary in October 2018, the board believes that its activities up to that point have yielded certain results, whereas it feels that more than ever, it must meet expectations and requests from many people including early release of accident or serious incident investigation reports and issuance of more effective preventive measures.

Specifically, we have been taking the expectations and requests made on us seriously and steadily are addressing them, and with the opportunity of the 10th anniversary, we are organizationally considering how we should proceed with an eye toward the next 10 years from the viewpoint of further promotion of safety of aviation, railways, and marine. At present, as the directions of the commitments we should focus on from now on, we have set up three functional pillars: enhanced analytical ability, enhanced communicativity, and enhanced internationality. We think that acquiring these abilities requires us to enhance the organizational strength and individual abilities, and thus we must continue to make efforts

with higher-quality goals set up.

Based on this idea, this special topic presents the directions of our future focused commitments with an eye toward the next 10 years as well as the recent efforts being made by the Japan Transport Safety Board.

Current Organisation of the Japan Transport Safety Board

[The Japan Transport Safety Board: Chairperson and board members**]**
The Japan Transport Safety Board consists of 13 people: a chairperson and 12 board members. The chairperson and board members are appointed by the Minister of Land, Infrastructure and Transport based on the Act for Establishment of the Japan Transport Safety Board, and specialize in many areas as shown below:

- ○ Common to all modes
  Laws (Anglo-American laws and evidence laws)
- ○ Aviation mode
  Aerospace engineering/strength of materials/composite material engineering, operation and maintenance of aircrafts, maneuvering of aircraft, aircraft guidance and control/flight dynamics, and ergonomics (human factors)
- ○ Railway mode
  Railway engineering/geotechnical engineering, dynamics of machinery/vehicle dynamics/railway vehicle engineering, structural engineering, and electrical engineering/traffic management (human interface)
- ○ Marine mode
  Ship operation/maritime traffic safety, marine engineering/naval architect, and safety ergonomics

[Secretariat]
The Japan Transport Safety Board has a secretariat for managing affairs of the board. For investigations at accident sites, accident investigators of respective modes (aviation, railway, or marine) are dispatched to conduct investigations and Director for Analysis, Recommendation and opinion and Director for coodination of the Accident Investigation are posted under Director for Management. In addition, a secretariat system is arranged that is supported by the general affairs section, which is responsible for such as international affairs and public relations.

The aircraft accident investigators consist of 25 experienced experts such as pilots, airworthiness engineer, inspector of airmen licensing, aircraft mechanics, and air traffic controllers. The railway accident investigators consist of 19 experts with experience in research and development of rail cars

and railway tracks, design and manufacturing of rail cars, directions and operation, inspection/maintenance, and analysis of weather conditions. The marine accident investigators consist of 23 experts, including experienced people such as captains, navigation officers, chief engineers, engineers, coast guard officers, and senior ship inspectors, and people with experience in, for example, actual investigation of accident sites.

The staff at the Director for Management (27 people) includes Director for Analysis, Recommendation and Opinion responsible for analyzing and statistically treating many accident and serious incident investigation reports publishing in the past and communicating a variety of safety measures through the Japan Transport Safety Board Digest, and other experts such as Director for Cordination of the Accident Investigation responsible for making coordination with organizations concerned in connection with investigations on accidents, etc. and providing victims with information. The General Affairs Division (24 people) embraces staff members responsible for Personnel Section, Accounts Office, Planning Section, General Affairs, and so on; the International Affairs Office responsible for making coordination for prompt and smooth investigations in partnership with accident investigation authorities in foreign countries and for coordinating collaboration with foreign countries; and the Public Relations Office responsible for communicating information by, for example, presenting information obtained through initial investigations or holding press interviews.

The Secretariat embraces eight regional offices (in Hakodate, Sendai, Yokohama, Kobe, Hiroshima, Moji, Nagasaki, and Naha with total 60 people), which are mainly responsible for investigating marine accidents and serious inccidents in their respective regions.

(All numbers of people are those as of April 1, 2019)

1 Enhancing the Analytical Ability

1-1 Enhancing the Ability to Conduct Scientific and Subjective Analysis

We need to conduct more reliable analyses and track down causes of accidents not only by gathering verbally expressed information from parties concerned but also by enhancing our ability to scientifically and subjectively analyze a variety of recorded data and video and weighing such analyses. For this reason, we will continue to enhance our analytical ability, the basis of accident investigations.

This section shows examples of investigations in which scientific and subjective analyses led to communication of recommendations and suggestions and presents the future directions for each of aviation, railway, and marine modes.

(1) Investigation of Aircraft Accidents and Serious Incidents

With the rapid development of aeronautical technology, we may be introduced to new safety

technologies that are beyond our knowledge and experience in a case, for example, where a new type of aircraft is being investigated; aircraft accident investigators are required to acquire new expertise and use it.

Under the situation, since a wide variety of data is now recorded when an accident or serious incident occurs, we track down causes by identifying how accidents occurred and making comparisons with other aircrafts using stored aircraft-specific data as well, and then collecting and analyzing video data recorded in external surveillance cameras installed at airports. In addition, we are improving our analytical ability by, for example, making it possible to reproduce the detailed environment at the time of accident occurrence using simulation programs, which are undergoing significant evolution.

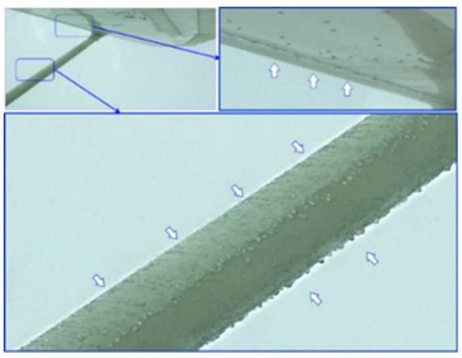
In conducting investigations of aircraft accidents, etc., there is no doubt that information recorded in flight recorders and records of communications is important for cause identification. Recently, information such as video and positional information may be recorded in smartphones and other electronic devices carried by individuals and therefore it is assuming importance to collect and analyze such records in investigating accidents involving light aircrafts or helicopters equipped with no flight recorder.

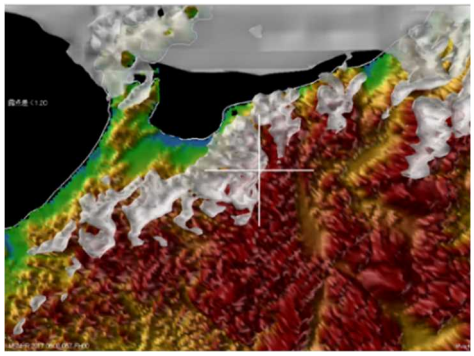
For field investigations of accidents in which aircrafts have crashed into steep mountains or when aircraft components are widely scattered, we are starting to use drones with excellent mobility.

○ Analysis of accident causes based on meteorological analysis using video analysis and a supercomputer (Aviation mode)

> On June 3, 2017, a Cessna 172P flying from Toyama Airport toward Matsumoto crashed into the vicinity of the top of Mt. Shishi-dake in the Tateyama mountain range (see Page 40).

For this crash accident, photos recorded in the smartphone of a person on board the same aircraft revealed that the aircraft was flying in clouds at that time and that the pilot did not wear a harness. In addition, analysis of photo data indicated that icing had been observed on the aircraft which destabilized the flight.





Furthermore, to identify the weather conditions around the peaks of the Tateyama mountain range in the time frame when the accident occurred, we asked Tokai University Research & Information

Center to conduct numerical analysis, using a supercomputer, based on the numerical prediction model provided by the Meteorological Agency in order to visualize at high resolution the wind conditions and cloud amount at that time around the Tateyama mountain range. These analyses revealed that aircraft had flown in clouds, which had caused ice to form on a wing, resulting in significant degradation in flight performance.

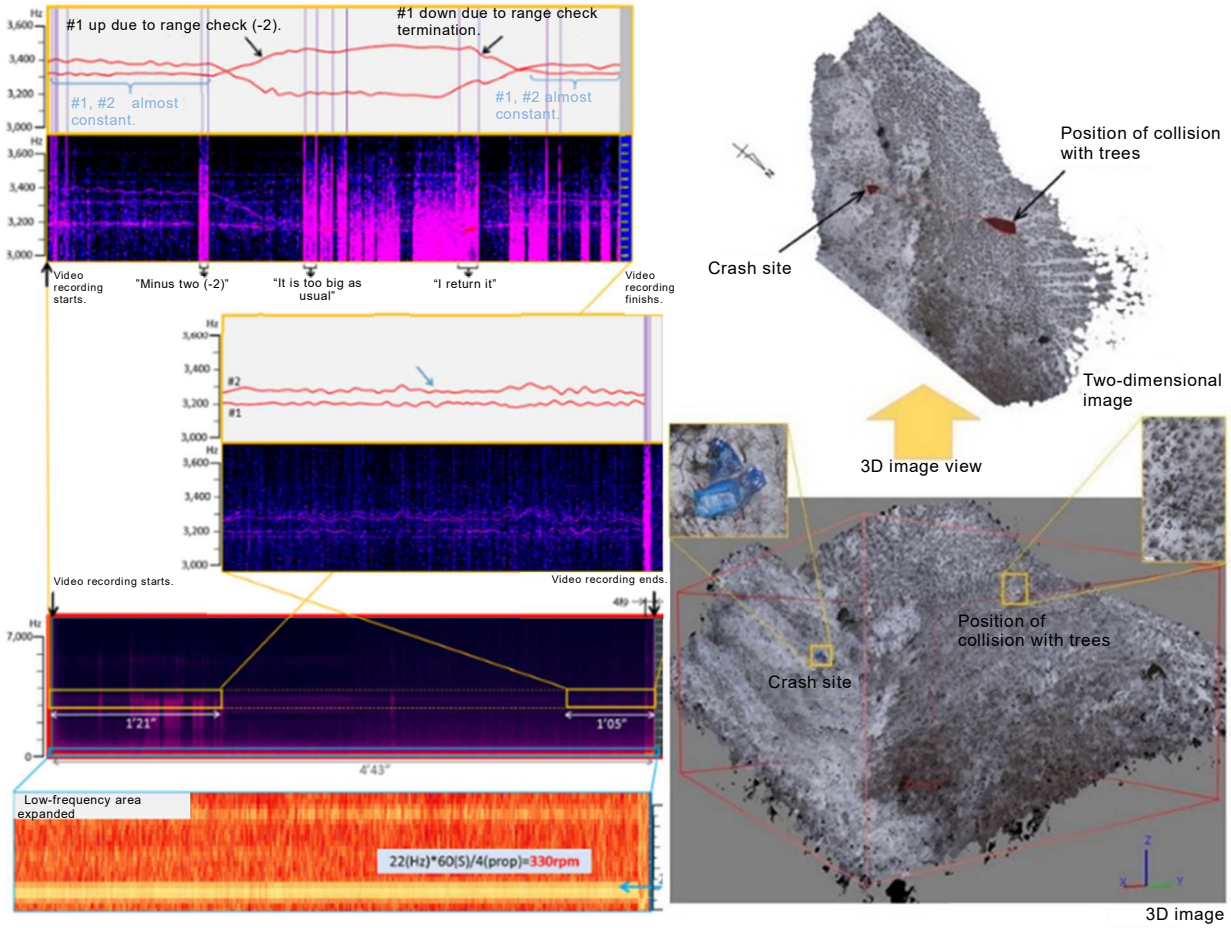
Based on these findings, the board made recommendations to the Minister of Land, Infrastructure and Transport, requiring safety measures that prohibit light aircrafts or the like incapable of in-cloud flight from flying into clouds.

○ Estimation of the conditions at the time of accidence based on analysis of video and acoustic data and use of drones (aviation mode)

On March 5, 2017, a bell-type 412EP, a fire-fighting disaster-relief helicopter, flying from Matsumoto Airport toward a temporary helipad in the mountains, Shiojiri City, Nagano Prefecture crashed onto the mountain's slope on Mt. Hachibuse in Matsumoto City (see Page 39).

For this crash accident, we analyzed video data recorded in a video camera attached to the helmet of a person on board the same helicopter to estimate the flight path, speed, and altitude of the aircraft. We also analyzed the acoustic data in the video camera to estimate the conditions of the engine operation and part of the conversation between the persons on board.

These analyses revealed that there had been nothing wrong with the aircraft until it collided with a



tree; that it was operated by one pilot; that the pilot had not stated his conditions correctly when applying for aviation medical certification; and that none of those on board had responded to the coming danger.

With these facts, the Fire and Disaster Management Agency decided to require fire-fighting disaster-relief helicopters to be crewed by two pilots and is trying to enhance the safety management system, training programs, and so on. In addition, the board required the Minister of Land, Infrastructure and Transport to instruct aircraft crews to report their health conditions correctly.

The accident occurred at a place located deep in mountains in Nagano Prefecture, which was covered with snow at the time of the accident. It was difficult to identify the geographic features of the site and the conditions of trees, and hence, using a drone, we took pictures of the site and areas around it (to collect data on geographic features and others) and made a three-dimensional topographical map to estimate the flight path right before the crash.

○ Analysis of electronic data retrieved from damaged electronic equipment (aviation mode)

On October 15, 2017, a serious incident occurred in which a Beechcraft A36 flying from Niigata Airport toward Fukui Airport made a forced landing and ditched in the river near Fukui Airport (see Page 118).

In this serious incident, an aircraft continued to fly using the fuel in only one fuel tank without switching between the fuel tanks provided on both of the right and left sides, which caused a fuel shortage and a subsequent engine stop, resulting in a forced landing and ditched in the river and the submersion of the aircraft.

The JTSB took out the GPS receiver and drive recorder from the aircraft and retrieved recorded electronic data in an intact state from the submerged disabled devices (for information about the retrieval of data from damaged electronic devices, see Page 127). We analyzed the electronic data and determined the flight conditions and the problem with the engine of the aircraft to track down the cause.

Addressing Domestic Jetliners

With an eye toward future commercial flights of domestic jetliners (SpaceJet), in order to fulfill its obligations, theJTSB must enhance its investigation ability so that as the accident investigation agency in a state of aircraft design, it can, for example, undertake detailed investigations on the design and manufacturing of the aircrafts concerned. We must, we believe, enhance our analytical ability in the design area, in particular; concrete measures are described in Feature 1: 3 Concerning efforts after the revision of the Establishment Act (see Page 3).

(2) Investigations of Railway Accidents and serious incidents

In the railway mode as well, the development of simulation technology greatly helps analyze the conditions at the time of accident occurrence and track down causes. The implementation of simulation analyses requires the theory and relevant data that are required to construct a model as sophisticatedly as possible as well as equipment for simulations. For this reason, we will try to work together with the Railway Technical Research Institute and other external organizations with expertise and rich experience in these areas so that we can conduct more reliable analyses.

To conduct more accurate analyses, we have started using video data from video recording apparatuses equipped with an onboard camera installed at the head of trains in addition to data from operation condition recorders and other devices, which we have been using so far. For an investigation of a level crossing accident that occurred at a level crossing without a automatic barrier machine, checking such video data reveals how the automatic barrier machine passerby concerned behaved (whether or not he or she stopped before the automatic barrier machine and checked that no train was coming, and at what speed he or she crossed the railroad), leading to suggestions about effective preventive measures.

○ Simulation analysis on a crack in a flatcar of a shinkansen (railway mode)

On December 11, 2017, a serious incident occurred in which a crack was found in a flatcar of a shinkansen.

This is a serious incident in which a crack was found in a flatcar frame mounted with wheels that support shinkansen cars, a motor for driving, and other devices.

To identify what caused the crack in the flatcar in the investigation, we conducted fatigue and breaking tests using a test specimen, a simulation analysis to estimate how the crack developed, and a simulation analysis to estimate the points of the flatcar where a high level of stress is generated. In addition, from a new viewpoint, we analyzed the effect of the deformation and other factors of the flatcar frame based on the air pressure inside the air spring unit recorded in the rail car data recorder to present a technique for estimating the development of cracks.

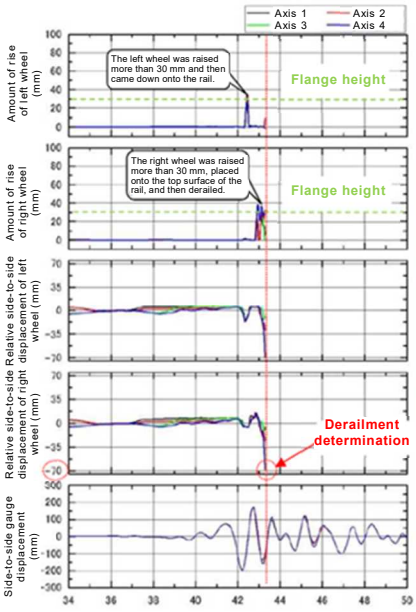
These analyses revealed that the crack had been caused by improper treatment during the manufacturing of the flatcar frame and that the crack had developed in a period shorter than the duration of the rail car life.

Based on these results, the board requested the Minister of Land, Infrastructure and Transport to ensure that necessary actions are taken in each stage of the manufacturing and design/verification processes of flatcar frames. Specifically, we requested the minister to ensure that manufacturing is thoroughly managed and that when a problem and/or difficulty arises in manufacturing, the effect of the measures against them on the safety is evaluated (see Page 77).

○ Simulation analysis on the behavior of shinkansen based on seismic vibration (railway mode)

On April 14, 2016, a shinkansen was derailed by the seismic vibration of the Kumamoto earthquake (a foreshock).

For this derailment accident, we decided to use a simulation to identify the cause of the derailment by reproducing the conditions of the rail cars derailed by the seismic vibration. In addition, to validate the execution conditions and results for each stage of the simulation, we appointed expert board members with knowledge about special fields (earthquake, structure, and rail car) to enhance the analytical system and asked the Railway Technical Research Institute for cooperation.



In the simulation, based on the seismic vibration observed when the earthquake occurred and the conditions of the ground, we estimated the earthquake wave immediately below the structure (elevated bridge) where the train was derailed and even estimated the vibration on the elevated bridge to analyze the behavior of the rail cars.

Based on these analysis results, the board requested in the accident investigation report further promotion of measures against derailment and deviation as preventive measures. The railway operators that run shinkansen are conducting studies to promote measures against earthquakes with preventive measures taken into account.

(3) Investigation of Marine Accidents and incidents

In the marine mode, for more scientific and subjective investigations of accidents and others, we retrieve data from nautical instruments such as voyage data recorders (VDRs), automatic identification systems (AIS's), and electronic chart display and information systems (ECDIS's).

In recent years, with some vessels, such as passenger boats, being equipped with a video recorder at the front window of their steering house, there are cases where conditions and other information at the time of accident are clearly recoded as video data. For collision and other accidents, we more subjectively analyze the conditions of, for example, ship handling and communication using such scientific data to look into the causes of accidents in greater depth for a higher level of investigations of accidents, etc.

In addition, we entrust investigations to the National Maritime Research Institute under the National Institute of Maritime, Port and Aviation Technology, which is a core research institution with expertise and skills about maritime/marine engineering, to have them conduct analyses of, for example, AIS data and impact simulation in further greater depth.

For further increased safety in vessel traffic, we have made a marine accident hazard map and

published it with the objective of calling attention to those concerned by indicating past accidents on this map along with their details (investigation reports on accidents, etc.) and having risks associated with each sea area overlap accident sites. At the beginning, the map was available only in Japanese, which became subsequently available in English and global versions. Recently, we also made a database of the past results of investigations of accidents, etc. and published it as an Engine Trouble Search System. We are widely making information known and promoting the use of it by, for example, making best use of these tools and clearly explaining the important points in preventing accidents at a variety of meetings and outreach lectures.

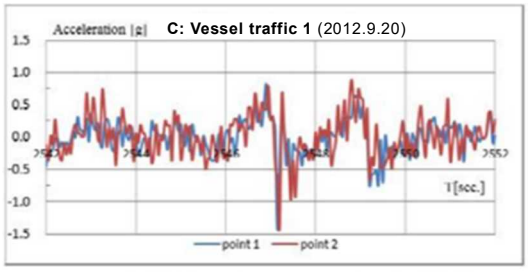
○ Evaluation of the dangers posed to passengers based on impact simulation (marine mode)

On June 24 and 26, 2012, passengers on board two passenger boats were injured off the southern coast of Iriomote Island, Taketomi Town, Okinawa Prefecture, when they were violently shaken by waves.

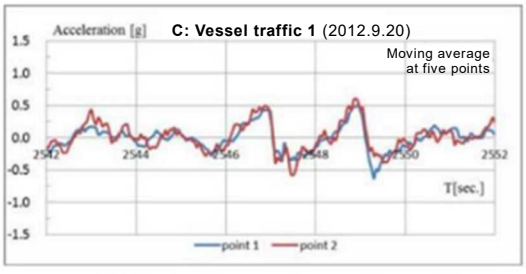
All of the passengers injured in this accident were seated in seats in the front part of the front cabin; they suffered lower-back injuries because of the impact they received when they were lifted by the shake and then dropped. For this reason, we measured and estimated the up and down accelerations at their seating positons. In addition, we compared the up and down accelerations at the various points between the two boats to evaluate the risk of lumbar fracture and reviewed accident prevention measures (safety of seats, seat belts, and others).

Based on these analyses, we presented preventive measures, such as guiding passengers to seats in the rear part of the vessel, ensuring proper usage of seat belts, and cushioning seats.

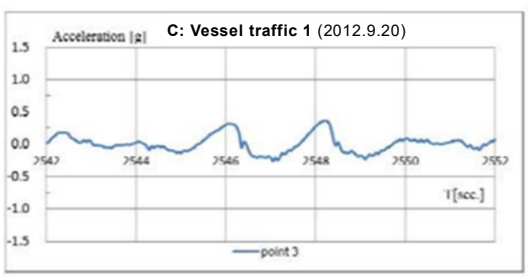
Under the situation, we made recommendations to the Minister of Land, Infrastructure and Transport, requiring the minister to ensure, for example, that small high-speed vessel operators



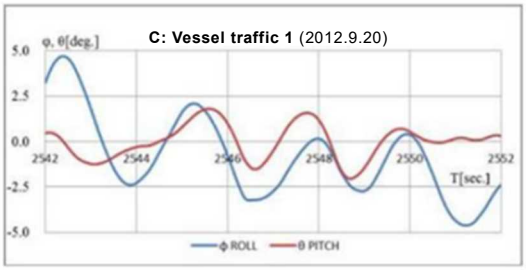
(a) Up and down accelerations at Points 1 and 2



(b) Up and down accelerations at Points 1 and 2 (smoothed)



(c) Up and down accelerations at Point 3



(d) Rolling φ and Pitching θ at Point 3

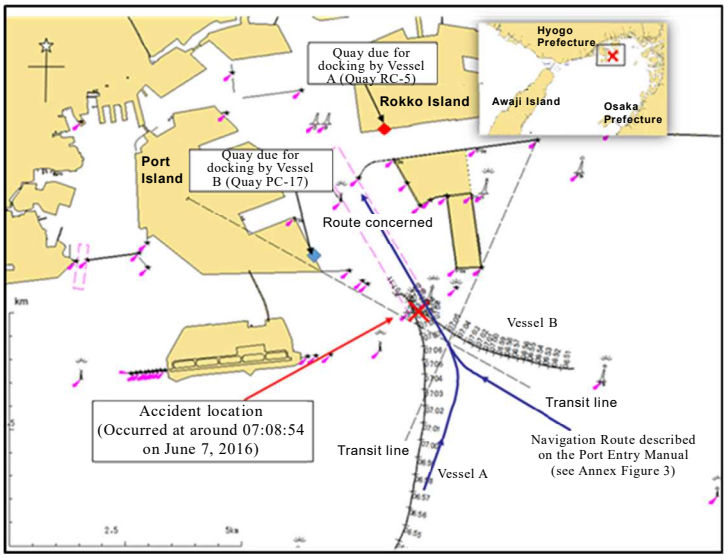
follow the manual for safe operation in stormy weather; that passengers are guided to seats in the rear of the vessel, which are less affected by shakes, and that passengers properly use seat belts.

○ Evaluation of collision risks based on analysis of AIS data (marine mode)

On June 7, 2016, a container ship (Vessel A with a gross tonnage of 170,794 tons) collided with another container ship (Vessel B with a gross tonnage of 9,948 tons) in the Kobe area of Hanshin Port (see Page 49).

For this collision accident, the collision risk was evaluated based on the AIS data of both vessels, which quantitatively indicated that the vessels had been in a dangerous state.

This evaluation was conducted with assistance from the National Maritime Research Institute under the National Institute of Maritime, Port and Aviation Technology and the navigation conditions were also analyzed based on the number of vessels called at the port.



Location of Accident Occurrence and Navigation Route

Vessel A

Vessel B

In combination with CREAM, one of the techniques for human factor analyses to be described later, these results help determine accident causes with a higher accuracy.

1-2 Enhancing Human Factor Analysis

Taking into consideration the fact that systematic analysis of human factors in accidents, etc. helps determine causes and develop preventive measures, the Japan Transport Safety Board has been enhancing human factor analysis. Through the collaboration with external organizations and training sessions, we are trying to deepen our understanding of characteristics of human capability, psychological disposition, and others and to incorporate techniques for human factor analysis

appropriate for each case, and working toward increasing our ability for investigation, including hearing of oral statements, and ability to identify factors behind accidents, etc. We will focus on human factors, which represent important factors in analysis, as well as studies on new analytic theories.

Here, some cases are shown where in background analysis, we used, among the techniques for human factor analysis, analysis on presence/absence of psychological dispositions called the normalcy bias and confirmation bias and the cognitive reliability and error analysis method (CREAM).

○ Operation was continued with irregularities observed such as unusual noises and a strange smell (railway mode)

(See "Simulation analysis on a crack in a flatcar of a shinkansen (railway mode)" on Page 12.)

On December 11, 2017, a serious incident occurred in which a crack was found in a flatcar of a shinkansen.

・Outline of the serious incident

While an attendant noticed irregularities such as unusual noises and a strange smell caused by a crack in a flatcar frame of a shinkansen, no underfloor inspection was conducted and the train continued to run a long distance at normal speed for the reasons there was a difference between the attendant and the dispatcher in understanding of the necessity of rail car underfloor inspection and each thought that the other would determine whether or not to continue the operation.

・Analysis of incident factors from the viewpoint of human factors

With focus placed on human psychological dispositions, we analyzed why they were unable to determine that there had been a problem with the train operation while they noticed irregularities such as unusual noises and a strange smell. People have a psychological disposition called the normalcy bias that makes you determine that any abnormal situation that occurs is a normal situation and try to remain calm (a psychological disposition that makes you think that there is no problem with the train operation and use wording that induces continuation of the train operation). People also have a psychological disposition called the confirmation bias that makes you choose and place importance on information that supports your wish or belief and disvalue and exclude information that goes against such information (a psychological disposition that makes you look at only the information that supports your idea to convince yourself that the idea that you do not want to stop the train is correct). In this case, we analyzed that the persons concerned had been unable to determine that there had been a problem with the train operation because these psychological dispositions affected them without them knowing it.

・Preventive measures from the viewpoint of human factors

Based on these analyses, we presented preventive measures assuming that people have the above psychological dispositions; we pointed out that it is important to modify the regulations and

other requirements to require the persons concerned to stop trains to check safety when one cannot know what is happening or has difficulty in making a determination and to make this requirement universally known to the employees.

This serious incident reassures that it is important to stop trains to check safety with top priority placed on safety in a case where a situation occurs that is not mentioned in the manual or other requirements or not in line with the regulations.

○ Two vessels collided with each other without the wrong recognition of both crews corrected (marine mode)

(See "Evaluation of collision risks based on analysis of AIS data (marine mode)" on Page 16.)

On June 7, 2016, a container ship (Vessel A with a gross tonnage of 170,794 tons) collided with another container ship (Vessel B with a gross tonnage of 9,948 tons) in the Kobe area of Hanshin Port (see Page 49).

・Application of the CREAM

For this collision accident, with assistance from the National Maritime Research Institute under the National Institute of Maritime, Port and Aviation Technology, we analyzed the factors that had caused the accident using the CREAM, one of the techniques for human reliability analysis, to (1) evaluate the work environment (evaluate the contribution to unsafe actions for each of three elements: individual, skill, and organization) and (2) identify the background factors (identify unsafe actions based on the ship handling record, oral statements, and other information to analyze the causes).

・Causes of the accidents identified through this analysis

The board used the CREAM for the first time to identify the (unsafe) actions that should be noted and the background factors. This resulted in the findings that information had not been smoothly shared because of the difference in the languages used and insufficient inboard/outboard communication, which caused the crews of both vessels to incorrectly think that their vessels had priority over the other, leading to the collision.

・Advantages of this analysis technique

This analysis method provides multifaceted analysis of multiple elements, leading to higher level analysis of causes of accidents. In conducting analyses, accident investigators gather verbally expressed information from boat controllers with attention paid not to fail to catch a variety of information; the CREAM is also useful in appropriately collecting information in the initial stage of the investigation because, for example, the use of the CREAM helps accident investigators standardize the information to be gathered in advance.

We believe that storing cases of investigations of accidents, etc. reveals the factors behind accidents, etc., enabling us to present more effective preventive measures.

Outline of the CREAM

- This technique is roughly divided into two stages. In the first stage, the work environment is evaluated and in the second stage, the background analysis of human actions is conducted.
- In the stage of work environment evaluation, the work environment at the time of the accident occurrence is evaluated from multiple viewpoints, such as the safety control system, including watching, and the validity of the vessel handling procedure, etc. at the time of port entering, with focus placed on the three elements (individual, skill, and organization) that affect human behavior, to determine whether or not the work environment was likely to cause crews to make errors of some kind.
- In the stage of background-factor analysis, information is collected such as the vessel handling record from the voyage data recorder and voice record of instructions, and information about actions that may compromise safety identified, for example, through the interview with the captain or the like. Then, the background of the actions, etc. is looked into in depth to identify and analyze the background factors that led to the accident.
- With similarity in direction, these evaluation and analysis results may be analyzed together with the above mentioned evaluation of collision risks based on analysis of AIS data (see “Evaluation of collision risks based on analysis of AIS data (marine mode)” on Page 16) to verify the analysis results, which accurately identify the cause of the accident.

1-3 Enhancing Multifaceted Analysis That Leads to Actions for True Prevention of Reoccurrences

To track down the causes of accidents, etc. and the causes of damage triggered by accidents, we will conduct not only “point” analysis, which addresses only individual accidents, etc., but also “multifaceted” analysis, which is conducted from various viewpoints such as changes in the social situation and comparisons with same-type and similar cases, including collection of information about, for example, similar cases and examples of measures that actually prevented accidents from the database of accident investigations disclosed so far. Based on the results of such analyses, we will suggest safety measures that more effectively help prevent reoccurrences.

This section describes cases where attempts were made to enhance the multifaceted analysis.

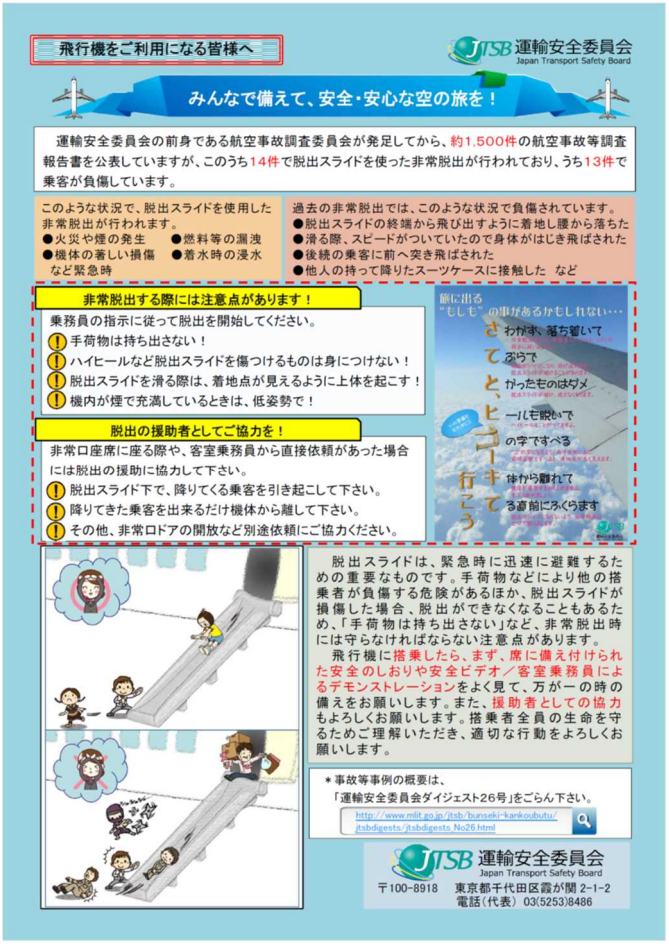
○ Measures for decreasing the number of injured passengers under emergency escape situations (aviation mode)

* Japan Transport Safety Board Digest No.26

Topic about injuries, etc. caused by the use of emergency escape slides

・On February 23, 2016, passengers were injured when they made an emergency escape from a Boeing 737-800 at the New Chitose Airport because of, for example, flames observed coming from an engine of it.

In this accident that occurred on February 23, 2016, many passengers made emergency escapes with baggage in their hands despite the instructions of the cabin attendants.



Escaping with baggage held in passengers' hands may delay the escape down the narrow aisles in aircrafts and such baggage may even hit other passengers and injure them or damage an escape slide, making it impossible for passengers to escape.

For this reason, using leaflets and posters prepared besides investigation reports, and the mail magazine issued by the board and other media, we are widely calling on general users to increase their understanding and recognition about the safety under emergency escape situations by telling them not to bring baggage when making an emergency escape.

We also published the Japan Transport Safety Board Digest No.26 (Japanese and English editions), which contained the results of analyses on past accidents of the same type. This digest presents statistics about emergency escapes and past cases as well as considerations (for example, about the importance of assistance from passengers under an emergency escape situation) based on experience in training on emergency escapes.

With the considerations, we concluded that:

- Many passengers were injured when they escaped using escape slides, meaning that it is possible to decrease the number of inured passengers if assistance from supporters is available under escape slides;

- Baggage brought by passengers when they try to escape may damage escape slides and other passengers;
- Baggage brought by passengers when they try to escape makes cabin attendants spend time handling it, hindering them from giving directions about the escape and helping passengers escape; and
- Cabin attendants alone can provide limited assistance for escapes and assistance from passengers prevents injury under an emergency escape situation.

However, ordinary citizens have almost no opportunity to experience an escape slide, meaning that they will experience a slide for the first time when they are in an accident or the like, and thus they may not appropriately give assistance. To obtain assistance from passengers, i.e., to ensure that they bring no baggage under an emergency escape situation and that they provide support other passengers under escape slides, it is also important that operators make further efforts to communicate the importance of such actions to passengers. Under the circumstances, it is desirable to ensure that ordinary citizens be able to appropriately assist escaping and provide support in the future by, for example, giving an explanation about emergency escapes at occasions such as events by operators or the like for ordinary citizens.

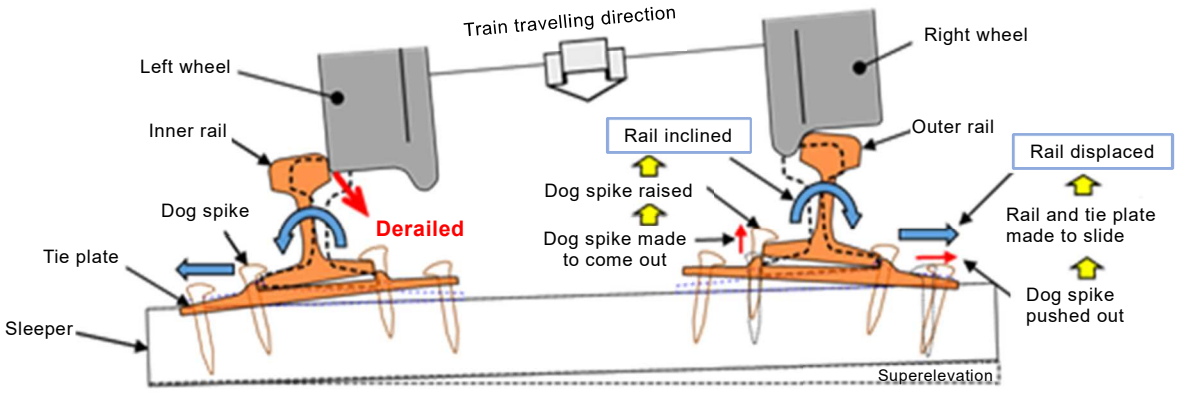
○ Measures for avoiding derailment due to widened track gauges (railway mode)

* Japan Transport Safety Board Digest No.28 (see (2) on Page 196)

Points in maintenance and management of track gauges toward preventing derailment accidents

- Ichihashi line of Seino Railway, on October 6, 2016
- Kishu Railway line of Kishu Railway Co., Ltd. on January 22, 2017
- Fujisaki line of Kumamotodentetsu Co., Ltd. on February 22, 2017
- Watarase Kiekoku line of Watarase Keikoku Railway Co., Ltd. on May 22, 2017

The railway accidents investigated by the Japan Transport Safety Board include four derailment accidents due to widened track gauges, which occurred between October 2016 and May 2017. These accidents seem to have been caused by the distance between the rails widened by rails inclined when a train passed because of successional problems with wooden sleepers and rail



Derailment due to widened track gauge

fasteners.

While the cause of widened track gauges varies from accident to accident, many factors are common to local railways. Based on the findings from the investigations of these accidents we determined, from the viewpoint of preventing similar accidents from occurring in local railways or the like, the following three key points to note, including the use of the existing public support systems and technical support systems (see Page 63).

(1) In inspecting and maintaining sleepers and rail fasteners (dog spikes), it is required to pay attention to the continuity of problems as well as give priority to sharp curves.
(2) To prevent derailment accidents caused by winded track gauges, track gauges should be appropriately maintained according to the gauge displacement situation. For this reason, the time limit for maintenance should be desirably clearly defined.
(3) Compared with wooden sleepers, sleepers made of concrete or similar material are durable and easy to maintain. It is desirable to systematically replace wooden sleepers with concrete sleepers (includes partial replacement to replace one in a few).

To address the appropriate maintenance of track gauges according to the trail displacement situation pointed out in (2), we communicated the fact that the Railway Technical Research Institute is developing a simplified measuring device mountable to commercial rail cars for measuring gauges and twist; it is expected that this device, if commercialized and introduced, will improve the accuracy in gauge measurement and help engineers in shortage.

Increasingly more derailment accidents caused by widened track gauges occur on local and other railways. It seems that, behind this situation are the facts that the number of passengers is decreasing, which is making it difficult to make investments in facilities and is thus promoting aging of facilities, and that the aging of employees and engineers is causing shortages of engineers, which is thus making it difficult to hand down technological skills.

○ Disclosure of examples of measures for preventing accidents involving an anchor dragging and measures for avoiding collision accidents (marine mode).

- On September 4, 2018, an oil tanker dragged its anchor off the southeastern coast of Kansai International Airport Island and collided with the connection bridge (see Page 163).
- On October 1, 2018, a cargo ship dragged its anchor in the Kawasaki area of Port of Keihin and collided with a quay (under investigation).

So far, the board has been investigating mainly vessels that have been in accidents and the like. On September 4, 2018, very strong Typhoon No. 21 passed the Osaka Bay. We conducted questionnaires about the situation when the typhoon was approaching and passing and the actions that were taken that did not prevent the accidents; we also conducted such questionnaires on vessels that had successfully avoided accidents. The survey on vessels that did not get in accidents

was a first attempt and a breakthrough.

With detailed analysis of the answers to the questionnaire, AIS data, and so on, we indicated as follows the important points in preventing accidents involving an anchor dragging under a situation affected by a very strong typhoon:

(1) When a vessel is anchored, basically two anchors must be used and all possible measures must be taken to, for example, ensure that anchors and anchor cables provide secure sufficient anchor-holding power with the anchor cables extended as long as possible. How to anchor the vessel and how long the anchor cable should be determined according to the vessel conditions and the anchorage environment on a vessel-by-vessel basis.

(2) It must be ensured that with the engine placed in a standby state, the output is appropriately adjusted by continuously using the engine according to rapidly changing wind directions and velocities so that anchor dragging will not be caused.

(3) An anchorage must be chosen so that no important facilities will be located on the leeward side of the anchorage and that sufficient distances to other vessels will be secured.

(4) Since the wind direction and velocity rapidly change when a typhoon is passing, it is required to acquire information about the latest weather and hydrographic (typhoon) conditions and accurately forecast the weather and hydrographic conditions. In conducting each action, it is critical to determine when to conduct it.

For the accident involving an oil tanker colliding with a bridge, a marine accident investigation report was published, which contained (1) to (4) above as preventive measures and indicated that the best evacuation place should be chosen by the captain, ship owner, and operator after consultation.

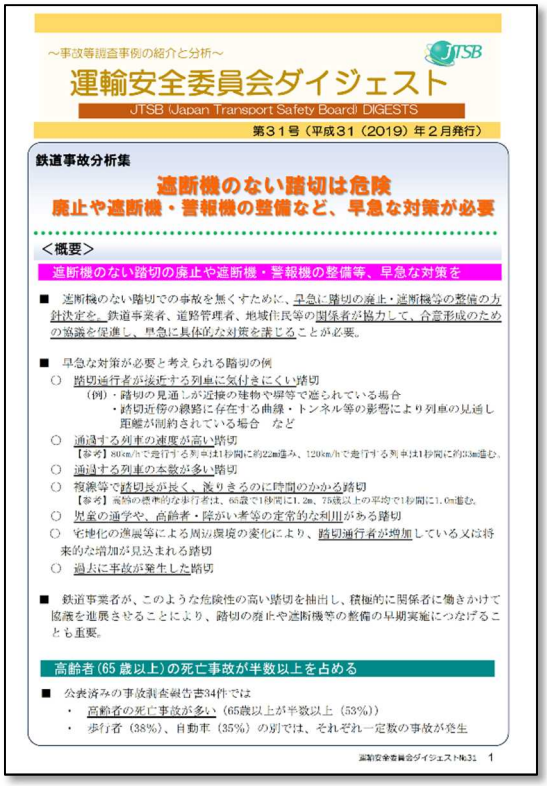
In addition, the report implied that a disaster that has reached an unprecedented level cannot be countered with only past experience and knowledge.

To appropriately cope with such a situation, we believe that the training sessions should be enhanced for enhancing the skills of the captain, the responsible person at the site, and crew and that the entire land-side organization including the parties concerned with operation should build a safety support system.

○ Response to an accident that occurred at a level crossing without automatic barrier machine (railway mode)

* Japan Transport Safety Board Digest No.31: Level crossings without automatic barrier machine are dangerous. They must be urgently addressed; for example, they must be abolished or equipped with automatic barrier machine and/or road warning device.
- Uchibo line of East Japan Railway Company, on September 27, 2016
- Gantoku line of West Japan Railway Company, on March 6, 2017 (see Page 142)
- Nishikyushu line of Matsura Railway Co., Ltd., March 23, 2017
- Rumoihonsen line of Hokkaido Railway Company, June 20, 2017

In April 2014, we added, to the list of accidents, etc. subject to investigation, level crossing obstacle accidents involving loss of lives at level crossings (class-3 and -4 level crossings) without automatic barrier machine, which have a high risk of accident.


～事故等調査事例の紹介と分析～

運輸安全委員会ダイジェスト

JTSB (Japan Transport Safety Board) DIGESTS

第31号（平成31（2019）年2月発行）

鉄道事故分析集

遮断機のない踏切は危険

廃止や遮断機・警報機の整備など、早急な対策が必要

<概要>

遮断機のない踏切の廃止や遮断機・警報機の整備等、早急な対策を

■ 遮断機のない踏切での事故を無くすために、早急に踏切の廃止・遮断機等の整備の方針決定を、鉄道事業者、道路管理者、地域住民等の関係者が協力して、合意形成のための協議を早進し、早急に具体的な対策を講じることが必要。

■ 早急な対策が必要と考えられる踏切の例

○ 踏切通行者が接近する列車に気付きにくい踏切
（例）・踏切の見通しが近接の建物や塀等で遮られている場合
・踏切近傍の線路に存在する曲線・トンネル等の影響により列車の見通し距離が制約されている場合　など

○ 通過する列車の速度が高い踏切
【参考】80km/hで進行する列車は1秒間に約22m進み、120km/hで進行する列車は1秒間に約33m進む。

○ 通過する列車の本数が多い踏切

○ 複線等で踏切長が長く、渡りきるのに時間のかかる踏切
【参考】高齢の標準的な歩行者は、65歳で1秒間に1.2m、75歳以上の平均で1秒間に1.0m進む。

○ 児童の通学や、高齢者・障がい者等の定常的な利用がある踏切

○ 宅地化の進展等による周辺環境の変化により、踏切通行者が増加している又は将来的な増加が見込まれる踏切

○ 過去に事故が発生した踏切

■ 鉄道事業者が、このような危険性の高い踏切を抽出し、積極的に関係者に働きかけて協議を進展させることにより、踏切の廃止や遮断機等の整備の早期実施につなげることも重要。

高齢者（65歳以上）の死亡事故が半数以上を占める

■ 公表済みの事故調査報告書34件では
・ 高齢者の死亡事故が多い（65歳以上が半数以上（53%））
・ 歩行者（38%）、自動車（35%）の別では、それぞれ一定数の事故が発生

運輸安全委員会ダイジェストNo.31　1

After that, 39 accidents that fall under this category occurred until January 2018. Under the situation, we analyzed railway accident investigation reports published so far, and in February 2019, we put together measures taken for accident prevention in the Japan Transport Safety Board Digest No.31.

In this process, we analyzed multiple accidents from various viewpoints to provide the following suggestions about measures required to prevent accidents, which we had been unable to do with individual investigation reports on accidents and serious incident.

- Elimination of accidents at level crossings without automatic barrier machine requires measures such as elimination of level crossings and maintenance of automatic barrier machines and other equipment. In particular, highly dangerous levelcrossings which, for example, trains pass at high speed require immediate measures.
- This requires the parties concerned, such as railway operators, road administrators, and local residents, to work together to promote consultations toward abolishing level crossings or construction of automatic barrier machine and other equipment.

This digest also indicates concrete cases that led to abolition of level crossings along with the points concerning abolishing level crossings.

The board will conduct field surveys on level crossings without automatic barrier machine and interview operators concerned to identify the actual conditions of level crossings and ensure that measures are implemented toward abolishing level crossings and building safety appliances of level crossing. The levelcrossings on which we will conduct field surveys will be selected based on the characteristics of each level crossing, such as train speed, number of trains, and road traffic, and such investigations will be conducted with the objective of searching for clues for accelerating the efforts by the parties concerned through evaluation of risks associated with the levelcrossings.

The interviews with the parties concerned will be conducted with focus placed on cases where level crossings without automatic barrier machine were abolished and level crossings became equipped with automatic barrier machine, aiming to build up and use know-how for promoting consensus formation among the parties concerned about individual concrete safety measures for level crossings. By aggressively making such efforts, the board is determined to contribute to further development of safety measures for level crossings.

○ Respond to shipboard fire and loss of power (marine mode)

・On July 31, 2015, a fire occurred on a passenger ferry off the southern coast of Tomakomai Port (see Page 48).
・On April 24, 2017, a fire occurred on a cargo ship at Hakata Port (see Page 51).
・On November 8, 2018, a cargo ship lost power and had a collision at Mizushima Port.

For the fire on the passenger ferryboat, it is deemed that when the fire started in a ship-borne truck, the crew did not appropriately extinguish the fire or prevent the fire from spreading, causing it to develop into a large-scale fire. For the fire on the cargo ship as well, a fire started from scrap in the cargo space and the crew did not appropriately extinguish the fire, using water instead of a carbon dioxide fire extinguisher. This spread the fire, causing the vessel to sink on the following day.

It is deemed that for both vessels, the captains or crews had not been sufficiently provided with practical training sessions that allow them to take required actions when they actually are faced with an emergency.

For the accident in which the vessel collided with breakwater because it had been made uncontrollable by a blackout caused by stoppage of the onboard generator motor, the vessel lost power because it had used fuel oil with water mixed in it and the emergency measures, including emergency anchorage, for a case where onboard power is completely lost were insufficiently established, resulting in a collision.

These cases indicate that the response in an emergency, if improper, does not reduce damage but leads to larger-scale damage. To counter this situation, we suggest operators and other organizations should be required to provide captains and crews with practical training repeatedly to maintain an organizational safety control system that allows for appropriate responses.

1-4 Summary of Suggestions from Accidents That Seem to Be Useful in Responding to the Social Situation and the Like

Recent years have seen accidents associated with traffic and transport, which have large impacts on society including peoples' life and the economy, and incidents that require reconsideration of how traffic operation (operators) should be. These accidents, etc. include many cases that seem to be affected by changes in the social situation, etc., such as the decreasing population/declining birthrate and aging population/shortage of people who shoulder responsibilities, increasingly more serious disasters, and aging infrastructures as shown in (1) to (3) below, and many other cases that seem to be associated with rapid development of technological innovation as shown in (4). Bearing these changes in mind, we will make efforts so that we can analyze causes and preventive measures in greater depth.

In addition, we believe that it is critical to comprehensively analyze the investigation reports on accidents, etc. published so far, with consideration that they are a valuable database, to ensure that as many as accidents as possible are prevented in early stages and to communicate the analysis results along with factors behind the changes in social situation, etc. and other suggestions beyond the boundaries among the modes of aviation, railways, and marine so that that they will be reflected in your actions for preventing accidents.

Considering that in responding to changes in social situation, cases of past accidents will act as useful clues, we are determined to communicate the suggestions mentioned above through the Japan Transport Safety Board Digest and other media not only to the operators that are directly related to accidents but also to the entire industries affected and even industries in the other segments so that we can make efforts that will lead to actions for avoiding accidents.

Below are examples of important suggestions derived from actual accidents.

Examples of important suggestions derived from actual accidents

(1) Decreasing population, declining birthrate and aging population, and shortage of people who shoulder responsibilities

i. Sharing and handing down of technological skills

In the fields of traffic and transport, security experts, who were commonly present at sites, are decreasing in number due to generation changes and other reasons, the skills associated with important directions and know-how to ensure security are not being sufficiently shared or handed down. Examples of recent accidents caused by this factor include accidents (such as the oil taker accident (see Page 163), the crack in a flatcar of a shinkansen (see Page 12), and the crash of a disaster-relief helicopter (see Page 39)) that were caused by insufficient understanding of important directions and know-how within the business unit concerned and/or involvement of

workers with insufficient proficiency and skills and that would later had a significant impact on entire society. In the future, it will be required to organizationally evaluate safety with reliability instead of leaving it to on-site workers so as to ensure that proficiency and skills of the staff involved in operation are maintained at high levels and that the safety system for operation and the like is secured.

ii. Implementation of practical training sessions

To minimize the damage associated with accidents, it is critical to respond smoothly and promptly under emergency situations. To respond under emergency situations, truly practical training sessions and lectures should be provided to a degree that allows crews to respond appropriately when an emergency occurs. However, an accident occurred (passenger ferry accident (see Page 48)) in which the fire was not organizationally extinguished in a prescribed procedure because the captain and crew were insufficiently trained and are thus unfamiliar with emergency deployment, fire extinguishing equipment, and machinery and materials. In the future, the organizations concerned and operators will be required to always make efforts to enhance training programs not only by always securing sufficient opportunities for training but also by establishing a system that ensures that the proper actions are implemented when an actual emergency occurs.

iii. Making the importance of the training for preventing accidents known to on-site staff (occurrence of similar accidents encountered by the same operator)

In recent years, there are cases where similar accidents are repeatedly encountered by the same operator and where accidents ascribable to violations of laws and regulations are repeatedly encountered (e.g., a serious incident in which Tosaden Traffic violated requirements for the security method (partially under investigation) and a violation of the obligations of see-route compliance after passenger ship “Sora” collided with a lighthouse (see Page 52)). These cases seem to have been caused by the fact that it is difficult to make results of investigations of accidents, etc. known to on-site staff. Under the circumstances, we believe that it is required to collect information about the latest cases associated with training for preventing accidents based on lessons learned from investigations of accidents, etc. and communicate such information to the industries not only in the fields affected but also in the other fields.

(2) Increasingly more serious disasters

In recent years, it is becoming more and more conspicuous that disasters are becoming increasingly more serious; recent serious disasters such as heavy rain and typhoons jeopardize safe and stable transport and prominently increase the risk of serious accidents.

The actual examples include an accident (an oil tanker accident (see Page 163)) in which a vessel anchored for evacuation from a typhoon was pushed by pressure and collided with the airport connection bridge, significantly affecting the airport functionality and other means of transport. To

prevent accidents by typhoons of this scale, the most important point is that the onsite staff appropriately prepare for disasters while it is also important that the staff concerned at the home office provide the onsite staff with concrete suggestions and information required for the onsite staff to make an appropriate determination as well as support that substantially increases the number of options from which the onsite staff can choose from; the involvement of the home office is also required instead of leaving it to the on-site staff. These measures are expected to provide effective responses conducted by the staff at the home office and onsite staff as a unified whole to avoid accidents.

(3) Necessity to maintain and repair infrastructures in anticipation of aging

The infrastructures in the traffic/transport filed are one of important elements that provide the basis of safe, stable transport. If they are not sufficiently maintained or repaired and thus the functionality that should be provided by them is lost, accidents can occur. The actual examples include derailment accidents caused by widened track gauges experienced by more than one railway operator and an accident experienced by Nankai Electric Railway in which bridge piers sank and a train is derailed. In these cases, the facilities were insufficiently maintained and repaired and the functionality that should be provided by infrastructures was lost, leading to accidents.

To prevent accidents caused by a malfunction of infrastructure due to insufficient maintenance and/or repair, it is required to properly inspect facilities on a daily basis and promote systematic repair and reinforcement of them if any abnormality is found. In addition, evaluations associated with the necessity of the above mentioned repair and reinforcement must be conducted subjectively and multifacetedly without any subjective views.

In preventing the accidents above, it is also effective to introduce new technologies such as a system that uses an onboard system for measuring track gauges while the train is running and a system that uses a sensor, such as an angle meter, installed on a bridge to monitor the conditions.

(4) Introduction of new technologies based on IoT, AI, or the like

With accelerations in the decrease in population and decrease in birthrate and aging of population, the problems associated with the shortage of security experts and manpower due to the shortage of people who shoulder responsibilities are expected to become increasingly more serious in the future. The introduction of new technology that use IoT, AI, or the like are important in that they may act as one of the measures against and support for the problems associated the shortage of people who shoulder responsibilities. The introduction of IoT and AI with sufficient consideration given to operation characteristics will produce positive impacts, i.e., enabling labor savings and efficiency improvement and improving work environments and increasing earning power.

On the other hand, in introducing new technologies that use IoT, AI, or the like, it is also critical to

sufficiently take their characteristics into account and allow check functions to work instead of entirely relying on them. An accident occurred (see Page 50) that seemed to be caused by a night-duty alarm (an anti-dozing device) installed on a vessel which did not activate because of an improperly installed sensor and thus allowing the person affected to fall asleep. It is required to regularly identify the actual operation after the installation and accurately detect a problem or a sign of a problem, if any, as well as share information among the parties concerned and take complete measures to prevent any problems.

In addition, technologies based on IoT devices must be used on the precondition that with sufficient consideration given to the fact that the devices are connected to the Internet and the security risk associated with it, it is ensured that latest measures are taken to minimize the risk. In preparation for a possible system failure, the system must include a built-in mechanism for sufficient checks and accident prevention that minimizes the damage by, for example, detecting failures in early stages, ensuring security, identifying the actual conditions of operation, sharing information among the parties concerned, and promptly performing correction.

Considering the situations stated in (1) to (4) above, to ensure safe, stable transport in future years, it is critical to work toward maintaining and enhancing the credentials of the parties concerned in the traffic/transport fields. Among others, to clear the problems one by one that the people who shoulder responsibilities for are lacking, those with insufficient proficiency and skills may be involved, natural disasters are becoming more serious, and infrastructures are aging, it is important to keep the system maintained so that it will allow the onsite staff to appropriately respond even if unusual situations occur. From these viewpoints, it is first required to secure opportunities for training sessions and lectures for safe, stable transport and make maximum use of them to prevent accidents; however, achieving this absolutely requires not only efforts at the level of individual operators but also a belief that the industry will work as a unified whole and involve players in the other industries to produce effects.

With this consideration, we believe that it is strongly required to:

- Apply best practices, manuals, and check systems established in excellent companies to other company; and
- Systematically make efforts to secure safety on an industry-wide basis or beyond the boundaries of industries to devise a mechanism that produces sufficient results.

It is deemed that in building safe, stable traffic/transport services, it is also important that users, operators, and administrative agencies collaborate with one another to make sustainable, effective efforts. To promote these efforts, the board is determined to consider in greater depth ideal accident-preventing activities with certain effectiveness based on data and subjective facts.

2 Enhancing Communicativity

(1) Appropriate communication of recommendations, suggestions, safety recommendations, and others

In the period from being setup to June 2019, the Japan Transport Safety Board worked on the identification of the causes of 279 aircraft accidents, 193 railway accidents, and 11,439 vessel accidents and published investigation reports on these accidents, etc. When it is deemed that measures or actions for preventing accidents, etc. and reducing damage are required, it has been making recommendations and suggestions for drafting safety measures and policies; specifically, in parallel with the publication of investigation reports on accidents, etc. it has been making recommendations[1] to the Minister of Land, Infrastructure and Transport and the parties concerned with the causes; making suggestions[2] to the Minister of Land, Infrastructure and Transport and the heads of the administrative agencies concerned, and/or making safety recommendations[3] to organizations concerned in foreign countries.

In the period from being setup to June 2019, the board made 14 recommendations, six suggestions, 11 safety recommendations in the aviation mode, five recommendations and five suggestions in the railway mode, and 15 recommendations, 16 suggestions, and 25 safety recommendations in the marine mode. We will continue to make recommendations and suggestions when it is deemed that measures and/or actions are required for preventing accidents or reducing damage.

(2) Quick provision of appropriate information to victims, etc.

As our action guidelines require consideration to victims, we are determined to quickly and appropriately provide information about accident investigations with sufficient consideration given to the feelings of victims and their families or families of those who lost their lives and to respectfully respond to their views.

To appropriately address victims and others, we set up the Victims and their Families Liaison Office in April 2012. Through this office, we are trying to achieve interactive communication by

1 Based on results of investigations of accidents, etc. the board can make recommendations to the Minister of Land, Infrastructure and Transport and the parties concerned with the causes to require them to implement measures that should be taken for preventing accidents, etc. The Minister of Land, Infrastructure and Transport is obliged to report what measures the minister has taken based on the recommendations to the Japan Transport Safety Board. If any party concerned with causes has not taken the measures associated with the recommendations, the board may disclose that fact.

2 The Japan Transport Safety Board may make suggestions to the Minister of Land, Infrastructure and Transport and the heads of the administrative agencies concerned to request them to implement measures that should be taken for preventing accidents, etc. when such measures are determined to be necessary based on results of an investigation of accidents, etc. or an investigation under way or results of multiple past investigation results.

3 For aircraft and marine accidents, in any stage of an investigation for accidents, etc., the Japan Transport Safety Board may require based on an international treaty, as necessary, organizations concerned in foreign countries to implement actions that should be immediately taken for securing higher-level safety.

providing information to victims and their families and families of those who lost their lives as well as respectfully listening to the views, including findings, of victims so that we can use them as clues for improving accident investigation activities (see Page 207).

(3) Early publication of investigation reports on accidents, etc.

Under the current conditions, a certain duration is required to put together investigation results into a report because doing so requires, for example, sophisticated analyses of data and hardware, interviews with a wide variety of parties concerned along with analysis of the findings, repeated discussions by task forces, and inquires to parties concerned for their views (for interviews with parties concerned for their views, the period for interview is defined, and for aircraft accidents, etc., in particular, a 60-day inquiry period must be given to the organizations concerned in foreign countries according to an international treaty). Our mission is to track down the causes of accidents, prevent reoccurrences of accidents, and reduce damage and we are aware that it is critical to achieve early publication of investigation results on accidents, etc. from the viewpoint of prevention of accident reoccurrences.

Based on such idea, we want to achieve early publication of investigation reports on accidents, etc. by sophisticating our investigation capability through enhancement of the training sessions and lectures provided to accident investigators and by adaptively and intensively deploying accident investigators according to the case. Two recent examples of early publication of reports are shown below:

○ Case of a houseboat fire

On March 27, 2019, a fire occurred in a houseboat made of FRP. We published an accident investigation report on June 27, 2019 in as short as three months before the busy period in summer, recommending the installation of equipment such as a gas stove equipped with a top burner temperature control or the like or an automatic-dispersion-type dry chemical extinguisher based on the fact that it is difficult to extinguish the fire unless it is extinguished before the FRP starts to burn because burning FRP continuously produces combustible gas.

○ Case of an anchor dragging caused by a typhoon (an oil tanker collided with an airport connecting bridge (see Page 163))

On September 4, 2018, when a very strong typhoon was passing the Osaka Bay, an accident occurred in which an anchored oil tanker dragged its anchor and collided with the connection bridge of Kansai International Airport. This accident caused the closure of the bridge, which isolated the airport, having a significant social impact. For this accident, we also published the accident investigation report as early as on April 25, 2019, eight months after the accident, in a shorter time than before.

(4) Progress reports and active communication of facts

In a case where a serious accident has occurred that has a particularly significant social impact or important information is found that must be made known in early stages to call attention and encourage inspection, the Japan Transport Safety Board reports the progress[4] and provides information[5] even before the publication of the investigation report on that accident.

We make it a rule to make progress reports in cases where it is determined that doing so is required because, for example, it is difficult to finish the investigation within a year. For the accident mentioned above in which an anchor dragging was caused by a typhoon (accident in which an oil tanker collided with the airport connection bridge), we made a progress report on December 20, 2018, three months after the accident, and published "Measures against Accidents Caused by Anchor Dragging for a case of a Very Strong Typhoon (intermediate report)," a report on examples of accident preventing measures for the other vessels anchored nearby, to provide information to the parties concerned (see Page 190). For an accident in which a cargo ship collided with a beam of the Oshima-Ohashi bridge on October 22, 2018, which caused a water pipe to break and resulted in the suspension of the water supply for longer than a month in almost all areas of Suo-Oshima town (see Page 163), we made a progress report on March 28, 2019, covering the progress of the accident, conditions at the time of navigation planning, and other information.

Such information is provided to the heads of the administrative agencies concerned when it is determined during the investigation that the information is useful in preventing accidents and reducing damage. One concrete case is a serious incident in which a large aircraft was stopped because its main landing gear was damaged at Narita International Airport on June 29, 2018, for which we provided information about the damage on the 24th of the following month (see Page 126). For a serious railway incident (facility failure) in which a signal post collapsed within the yard of Shin-Sapporo Station on November 14, 2018, we provided information about facts associated with the condition of the installed anchor bolts 5 days after the accident (see Page 149). In addition, for a railway accident resulting in injury or death in which a train car collided with a bumping post in the Yokohama Seaside line on June 1, 2019, we provided information about the records of disconnection and operation of equipment 13 days after the accident.

We will provide information about progress and facts more actively and faster, with the consciousness that in the future, we will be able to make recommendations even before completion of investigations because of the partial revision to the Act for Establishment of the Japan Transport Safety Board as described in Feature 1 (see Page 3).

4 Progress reports are made in cases where it is determined that doing so is required because, for example, it is difficult to finish the investigation within a year. Although preparation of progress reports requires a certain duration because it requires the same procedure as for publishing reports on analyses, oral statements, task force discussions, reference to views, etc., we will try to publish progress as early as possible as required.

5 Information is provided to the heads of the administrative agencies concerned when it is determined during the investigation that the information is useful in preventing accidents and reducing damage.

(5) Active communication of safety measures derived from multifaceted analysis and suggestions derived from accidents that seem to be useful in responding to the social situation and the like

Toward developing an awareness of prevention of accidents and their reoccurrences, we conduct not only "point" analysis, which addresses only individual accidents, etc., but also "multifaceted" analysis, which collects information about similar cases and examples of measures that prevented accidents from the database of accident investigations disclosed so far to achieve analysis from various viewpoints such as changes in the social situation and the like. As part of such efforts, we publish the Japan Transport Safety Board Digest; so far we have published 32 issues.

Recent issues of the Japan Transport Safety Board Digest deal with subjects such as "Passengers Who Were Injured When They Used Escape Slides Under an Emergency Escape Situation" (see Page 20 of the of Japan Transport Safety Board Digest No.26), which is an analysis of measures for decreasing the number of passengers who are injured when they escape from aircrafts, and "Important Points in Maintenance and Management of Track Gauges toward Preventing Derailment Accidents" (see Page 21 of the Japan Transport Safety Board Digest No.28), which is an analysis of derailment caused by widened track gauges.

As stated above, we will continue to actively communicate, through the Japan Transport Safety Board Digest and other media, safety measures derived from multifaceted analysis and suggestions useful in addressing the social situation and others, derived from, for example, comparisons among past cases of the same type and similar cases and then we will use such information in holding symposia beyond the boundaries of the aviation, railway, and marine modes, hold meetings with operators for exchanging opinions, and share it with investigation organizations in foreign countries.

3 Enhancing Internationality

(1) International cooperation in conducting accident investigations

The Japan Transport Safety Board must arrange an environment that allows it to cooperate with accident investigation organizations in foreign countries to swiftly and smoothly conduct investigations and prepare appropriate investigation reports on accidents, etc.

i. Building and enhancing the relationships with the countries involved in aircraft design/manufacturing, countries where our jetliners will be in service, or the countries above which our jetliners fly, with an eye toward future commercial flights of domestic jetliners.

In the mode of aviation, when commercial flights of domestic jetliners come into service and if

they should cause an accident or the like in a foreign country, Japan must immediately contact the authority in that country as the country involved in the design and manufacturing of the jetliner and then participate in the investigation by, for example, dispatching aircraft accident investigators. For this reason, we must build an international network with authorities in foreign countries and enhance it with an eye toward, for example, the development of future commercial flights of domestic jetliners.

To this end, we are required to:

- Conclude in order cooperation agreements for smooth implementation of investigations with authorities in foreign countries to confirm the intention to cooperate with each other in investigating accidents, share emergency contacts, and cooperate in investigations in the manners compliant with the requirements defined in an annex to the agreement, with the objective of speedily and smoothly implementing an accident investigation when an accident occurs in a foreign country (so far we have concluded agreements with authorities in eight countries and areas). Considering the level of impact of modern day accidents for international flights in particular, we must conclude agreements with countries with many international flights in service;
- Build collaborative relationships with countries involved in aircraft design/manufacturing, such as the U.S.A., and France, in addition to the countries where commercial flights of domestic jetliners are expected to be in service by concluding agreements with them and enhance the collaborative relationship with other countries involved in aircraft design/manufacturing by, for example, holding periodic meetings and meetings for exchanging opinions with them;
- Develop and enhance personal connections and build trust-based relationships by making maximum use of international conferences such as conferences by the International Society of Air Safety Investigators (ISASI) and ICAO Accident Investigation Panel to mix with and have meetings with other countries involved in aircraft design/manufacturing and countries with which Japan has concluded agreements;
- Aim to play a leading role in and contribute to accident investigations in the future, based on the fact that countries involved in aircraft design/manufacturing hold important posts in major internal conferences associated with accident investigations held by the international association of investigations on aircraft accidents and other organizations, by holding an important post in international conferences as other countries of design/manufacturing do and playing an important role; and
- As a country involved in aircraft design, make efforts to develop human resources that are able to appropriately cope with international investigations by providing sufficient opportunities for training on design and manufacturing of domestic jetliners, such as training based on a flight simulator, classroom lectures on design concepts and other subjects, training on maintenance and verification of actual aircrafts.

ii. Building a system associated with information exchanges in conducting international investigations on marine accidents

For international investigations of marine accidents, if an accident occurs in Japan or a foreign country, the investigation authorities in the coastal state and the country in which the vessel concerned is registered must contact each other and work together to proceed with an investigation according to the International Convention for the Safety of Life at Sea. To this end, in preparation for future serious accidents around Japan involving foreign-registered vessels or Japanese-registered vessels, we must build a network with the authorities in (coastal states) along which routes important for Japan run and in countries in which vessels that are likely to enter ports in Japan are registered and enhance this network. In light of this situation, we will:

- Hold periodic meetings and sessions for exchanging opinions with the authorities of Singapore and other important countries based on bilateral frameworks such as cooperation agreements (concluded only with Singapore at present) in order to build a system for more swift and smooth information exchanges;
- Try to develop and enhance personal connections with countries in which vessels are registered and build trust-based relationships with them by making use of international multinational conferences (such as accident investigator meetings); and
- Aim to hold an important post in international conferences associated with global standardization to be a world leader and contribute to accident investigations in the future.

(2) Building a network toward playing a leading role in global standardization

We will actively participate in conferences for global standardization of accident investigations held by the ICAO (International Civil Aviation Organization)[6] and the IMO (the International Maritime Organization)[7] and improve our presence in the conferences of international and Asian accident investigation organizations.

For the framework for global standardization associated with aircraft and marine accident investigations, we participate in:

- The working group of ICAO Accident Investigation Panel in the aviation mode; and
- The correspondence group of the subcommittee of IMO rule implementation in the aviation mode.

6 ICAO (International Civil Aviation Organization) carries out a variety of activities such as drawing up of treaties on air transport operations and aviation security issues, including measures against hijacking; monitoring of the safety monitoring systems of the countries to treaties; and coping of environmental issues, with the objective of developing the rules and technology for international aviation and promoting planning and development of international air transport. As of March 31, 2018, the number of member countries is 192.

7 IMP (International Maritime Organization) was set up in 1958 as a specialized agency. It carries out a variety of activities that are mainly associated with maritime safety of human life and technical and legal issues associated with safety of vessel navigation, etc., such as promotion of intergovernmental cooperation, development of effective safety measures, and drawing up of treaties. As of March 31, 2018, it consists of 173 member countries and three associate member areas.

In addition, to allow our presence to be improved in the conferences of international and Asian accident investigation organizations, we participate in:

- The International Transportation Safety Association as a multimode framework (where the managers of accident investigation organizations gather);
- International association of aircraft accident investigators and Asian association of aircraft accident investigators in the aviation mode; and
- International conferences of marine accident investigators and Asian Conferences of marine accident investigators in the marine mode.

In addition, as trips by international cruise ships increase, it will be more important to share information among countries concerned. We believe that it is required to raise issues about this situation with an eye on setting up a platform for discussing the problems to be encountered in responding to accidents associated with international cruise ships as well as how the framework for international collaboration should be.

(3) International collaboration mainly among Asian countries

We will support development of human resources in the accident investigation field in the countries and areas in which we will introduce our infrastructures.

In the railway field, in particular, it is required that the government and private sector work together on the development of human resource as a unified whole as support for the development of human resources in the railway accident field through JICA and other projects. Under the situation, it is becoming obvious that with export of Japanese-made rail cars, Japan is increasingly more requested to support the development of human resources to be involved in the safety of the railway that supports the technological capability and brand power. In this field, it is also required to promote self-sustained and continuous development in the target countries so that the safety quality will take root in the organizations concerned in foreign countries; it is becoming critical to build a cycle in which causes are tracked down through investigations of accidents, etc. and implementation of safety measures. For this reason, in the future, the board must urgently enhance its capability to develop human resources so that it can constantly provide high-quality training sessions in response to requests for support from the countries that handle rail cars and the like made in Japan. From this viewpoint, we will:

- Identify the concrete needs (needs associated with support) of the target countries (such as countries to which our support will be provided) through JICA projects and others; and
- Develop training programs and learning materials that reflect our know-how in each of the technical areas such as rail cars, track gauges, and signal systems so that the board can provide higher-quality training sessions according to the needs of target countries; in doing so, we will make use of external resources.

4 Enhancing the Organizational Strength and Individual Abilities

We are placing more focus on the enhancement of organizational strength and individual abilities because it is, we think, absolutely required by the achievement of the enhanced analytical capability, enhanced communicativity, and enhanced internationality mentioned so far.

(1) Enhancing the organizational strength

The Japan Transport Safety Board has been providing training aiming to increase mainly individual abilities. As a result, we recognized the importance of free and open-minded exchanges of views that activate the entire organization and we believe that we are required to have a common understanding of the latest conditions and problems at present and make efforts that help build an organization. In addition, we will consider promoting mutual understanding between accident investigators and administrative officials and increasing personnel exchanges between them.

Furthermore, we will try to enhance the management functionality and coping ability so that we can appropriately make an organization-wide response when a big accident or an accident involving more than one mode occurs or even a disaster occurs. From this viewpoint, we will improve the operation environment and develop human resources so that the entire organization–not only the headquarters (in Tokyo) of the board but also the local offices that provide support in the initial stage of investigations–can deliver its collective strength as a unified whole.

(2) Enhancing the individual abilities

We believe that in combination with the enhancement of the organizational strength above, we must continue to work on the enhancement of the abilities of individual staff members. For highly professional engineers, among other efforts, we are reviewing concrete measures that allow us to strategically procure and develop human resources over the long term. In addition, we will further increase the opportunities for training sessions and lectures that allow all of the accident investigators and administrative officials to advance their knowledge based on the situation in which they are placed and the roles they are expected to play and help enhance cooperation within the organization.

Summaries of major aircraft accident and serious incident investigation reports (case studies)

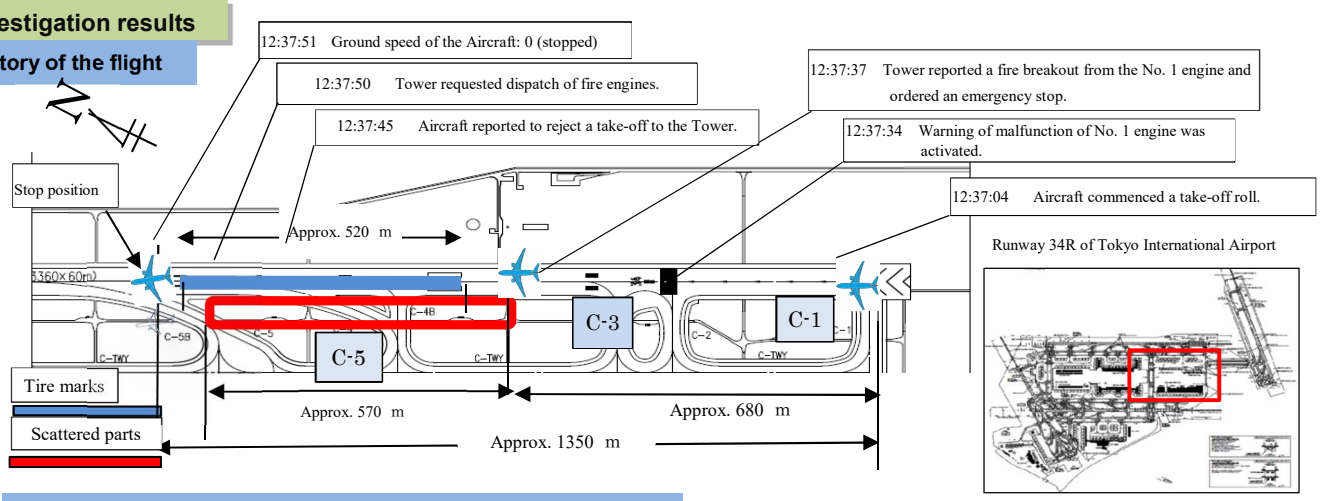
Fire during take-off roll

KOREAN AIR LINES CO., LTD. BOEING 777-300, HL7534

Summary of the Accident: On Friday, May 27, 2016, a Boeing 777-300, registered HL7534, operated by Korean Airlines Co.,Ltd, as the scheduled Flight 2708 of the company, flight crew had a rejected takeoff on runway 34R at the Tokyo International Airport during a takeoff roll to Gimpo International Airport, because there was a warning to indicate a fire from the No.1 (left-side) engine activated at around 12:38, the flight crew stopped the aircraft on the runway, and conducted an emergency evacuation. There were 319 people in total on board, consisting of the PIC, sixteen other crew members, and 302 passengers. Among them, 40 passengers were slightly injured.

Investigation results

History of the flight



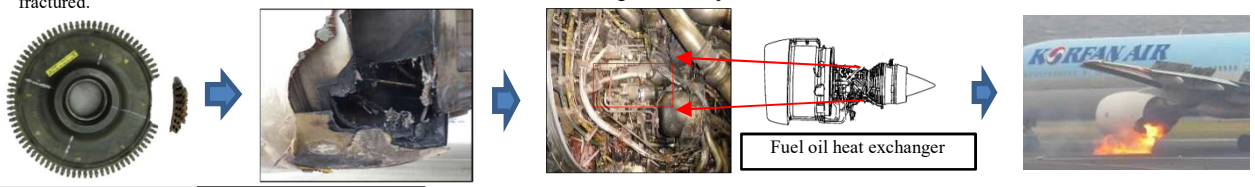
Fracture of 1st stage high pressure turbine disk (HPT disk)

(1) Due to low-cycle fatigue, a crack propagated and fractured.

(2) The fractured part penetrated through the engine case.

(3) A crack occurred in the fuel oil heat exchanger due to impact, etc.

(4) Fuel and engine oil that leaked through the crack ignited.

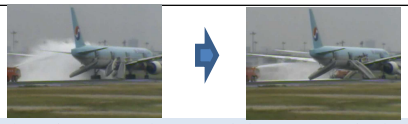


Background of fracture and fire

○ The U-shaped groove on the aft side of HPT disk had a step, but it was not noticed and the product was shipped out before any action was taken.
← Mistake in manufacturing and confirmation failure of inspector (the area was not specified as a critical location to be inspected)
○ A crack generated in the HPT disk. <- As a result of repetitive stress at every cycle
○ The crack was not detected by fluorescent penetrant inspection. (-> Crack propagated.)
← It is possible that the operators and inspector focused on the priority locations and as a result overlooked the step in the U-shaped groove.

Fracture of the rim of HPT disk → Damage of HPT case → Crack generated in the outer case of fuel oil heat exchanger.

Fuel, etc. that leaked out touched the heated area of No. 1 engine. → Fire occurred.



Action taken during emergency evacuation (No. 2 engine side)

○ Action taken by flight crew: Before the No. 2 engine stopped, the crew gave an instruction of emergency evacuation. The No. 2 engine stopped about 28 seconds after the crew opened the first door.
← The captain told the copilot to give an emergency evacuation order, but the copilot could not find the emergency evacuation checklist of QRH (quick reference hand book). As a result, it is somewhat likely that the copilot could not read out the checklist right away.
○ Deployment of evacuation slide: Due to the effects of resultant wind caused by the 20-kt wind and 37.5-kt engine exhaust from the No. 2 engine, the slide folded and slipped under the rear end of the Aircraft while it deployed. It could not return to the normal standing position spontaneously.

Probable Causes (Summary): It is highly probable that the causes of this accident were the fracture of the high pressure turbine (HPT) disk of the No.1 (left-side) engine during the takeoff ground roll of the HL7534, the penetration of the fragment through the engine case and the occurrence of subsequent fires.

For details, please refer to the accident investigation report. (Published on July 26, 2018)
http://www.mlit.go.jp/jtsb/eng-air_report/HL7534.pdf

In addition to the responses to technical issues related to the manufacturer and user of the engine, it is desired that the documents to be placed on the aircraft be properly managed and that passengers be thoroughly informed of appropriate action to be taken in the case of emergency evacuation.

Collision with trees and crash as a result of avoidance maneuver not taken even when getting close to trees

NAGANO FIRE AND DISASTER PREVENTION AVIATION CENTER BELL 412EP (ROTORCRAFT), JA97NA

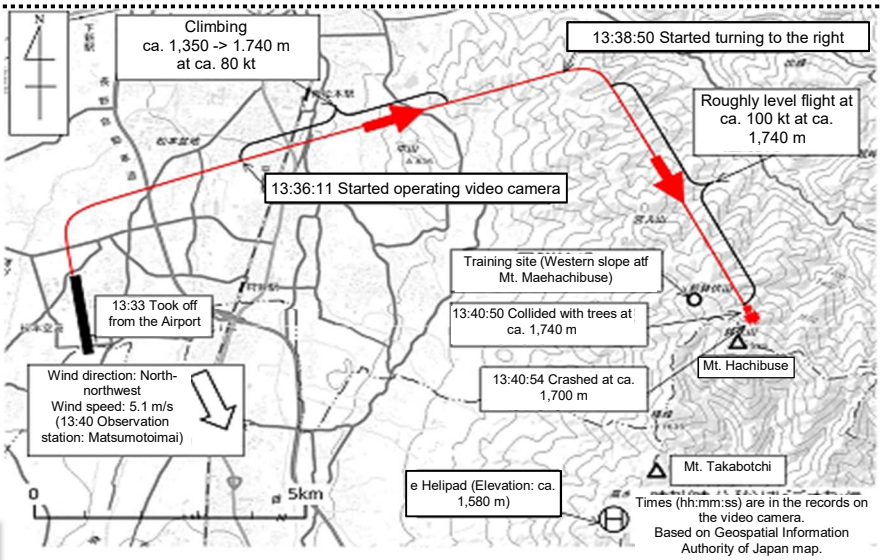
Summary of the Accident: On Sunday, March 5, 2017, at 13:33 Japan Standard Time (JST: UTC + 9 hours; all times are indicated in JST on a 24-hour clock), a Bell 412EP, registered JA97NA, operated by the Nagano Fire and Disaster Prevention Aviation Center took off from Matsumoto Airport and was flying toward a temporary helipad in the mountains, Shiojiri City, Nagano Prefecture to conduct rescue training. At around 13:41, it collided with trees and then crashed onto the mountain's slope on Mt. Hachibuse, Matsumoto City, Nagano Prefecture.

There were nine persons on board the helicopter, consisting of a captain, eight others and all of them suffered fatal injuries.

The helicopter was destroyed, but there was no outbreak of fire.

Investigation results

Estimated flight route



Situation when getting close to the ground

○ It is highly probable that the helicopter did not take either the avoidance route at a constant altitude by directly heading for the destination or the avoidance route by climbing, and that the helicopter continued to fly toward Mt. Hachibuse at a constant altitude until it approached the ground.

Reason for not taking avoidance maneuver when getting close to the ground

○ It is possible that the captain could not recognize the dangerous situation and so did not take any avoidance maneuvers because he was in a state where the arousal level was lowered with microsleep, and so on, due to the effects of fatigue and time difference. However, it was not possible to clarify whether he was actually in such a state.

Captain's conformity to the standards for aviation medical examinations

○ It is highly probable that the captain had a past medical and surgical history and was under treatment with medication. However, it is certain that the captain obtained the medical aviation certification without making a self-report on his medical information.

Regarding CRM during the flight

○ The mechanic did not warn the captain of the approaching danger.

→ The leadership of captain is required to establish the CRM appropriately based on the flight operations

Regarding ELT

○ There was no information concerning the receipt of a radio signal.

→ Possibility of G switch being stuck, and importance of periodic inspections

Regarding flight recorders

○ Aircraft are required to fly within small safety margins.

⇒ It is desired that flight recorders be installed in aircraft.

Contributes to analyzing/evaluating circumstances, understanding flight operations, identifying causes of accidents, and developing reoccurrence prevention

Probable Cause: It is highly probable that in the accident occurred, while flying in a mountainous region, the helicopter collided with trees and crashed, because the helicopter did not take avoidance maneuver even getting closer to the ground.

Regarding the helicopter's not taking avoidance maneuver even getting closer to the ground while flying in a mountainous region, it is somewhat likely that the captain could not recognize the dangerous situation because the captain was in a state where the arousal level was lowered, however, it was not possible to clarify whether he actually fell into such a state.

For details, please refer to the accident investigation report. (Published on October 25, 2018)
http://www.mlit.go.jp/jtsb/eng-air_report/JA97NA.pdf

The Japan Transport Safety Board has stated opinions to the Ministry of Land, Infrastructure, Transport and Tourism.

For details, please refer to "Chapter 1: Summary of recommendations and opinions issued in 2018 (page 60) ".

It is desired, among others, to ensure appropriate captain leadership, establish the CRM responding to flight operations, introduce a two-pilot system with the difficulty level of flight operation taking into account. Flight crew are required to correctly report their health conditions when applying for a medical aviation certification.

Crash into the vicinity of the mountaintop as the aircraft went into clouds during vfr flight

NEW CENTRAL AIRSERVICE CO., LTD. CESSNA 172P, JA3989

Summary of the Accident: On Saturday, June 3, 2017, a Cessna 172P, registered JA3989, operated by New Central Airservice Co.,Ltd., took off from Toyama Airport, while flying to Matsumoto Airport, at around 14:50 Japan Standard Time (JST: UTC+9 hours, unless otherwise stated all times are indicated in JST), it crashed into the vicinity of the top of Mt. Shishi-dake (elevation about 2,700 m) in the Tateyama Mountain Range.

There were four people on board the Aircraft consisting of a PIC, a pilot and two passengers and all of them suffered fatal injuries .

The aircraft was destroyed but there was no outbreak of fire.

Investigation results

History of the flight

Circumstances after takeoff from Toyama airport up to flying over the mountains

- It is somewhat likely that the aircraft was navigated not by the captain (who held an Instrument Flight Certificate) but by another pilot in the aircraft.
- It is considered that the VMC were maintained while the aircraft was climbing from Toyama Airport toward the Tateyama Mountain Range.

→ The aircraft changed to go on a southerly route. (It is assumed that the mountains were covered with clouds.)

→ It is possible that, in a state of low visibility (see the photo outside the window), the pilot might fly the aircraft with advice from the captain or the captain might take control of flying the aircraft.

Flight situation of the aircraft after deciding on turning back (Point d in the estimated flight route map)

→ It is likely that because the aircraft went into in-cloud flight and the pilots also noticed ice build-up on the aircraft, they tried to go back. (It is somewhat likely that the flight performance deteriorated extremely due to ice build-up and the aircraft became unable to maintain its altitude.)

→ It is probable that the aircraft was flying while looking for clouds rifts.

→ It is probable that it became difficult for the pilot to grasp its own position and surroundings, causing the Aircraft to crash into the mountain surface near the top of Mt. Shishi-dake

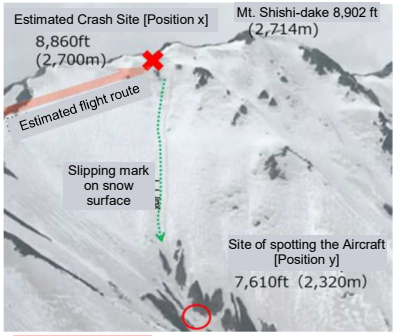
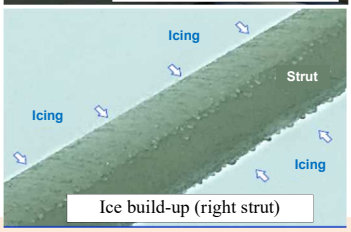


Photo of accident site

Photo outside the window



Ice build-up (right strut)

Probable Cause: It is probable that as the Aircraft got into clouds during VFR flight over the mountain region, it became difficult for the PIC and the Pilot to grasp its own position and surroundings by confirming visually the terrain, then, the Aircraft approached the vicinity of the mountaintop and crashed into it.

It is somewhat likely that the Aircraft approached the vicinity of the mountaintop and crashed into it due to loss of visual contacts making the crash unavoidable, or due to failure to maintain minimum safe altitude caused by the Aircraft icing or stalled condition, or due to encountering a severe turbulence. However, it could not be determined, since the PIC and all members on board suffered fatal injuries .

Concerning the fact that the Aircraft came to fly into clouds, it is probable that the PIC and the Pilot had not confirmed thoroughly the weather forecast for the mountainous region before departure and they delayed in making a decision to turn back during flight.

For details, please refer to the accident investigation report. (Published on August 30, 2018)
http://www.mlit.go.jp/jtsb/eng-air_report/JA3989.pdf

The Japan Transport Safety Board has stated recommendations to the Ministry of Land, Infrastructure, Transport and Tourism.
For details, please refer to “Chapter 1: Summary of recommendations and opinions issued in 2018 (page 54).

It is desirable to provide weather forecasts with safety first and ensure an appropriate decision to go back during in-cloud flights. The aircraft not certificated for flight in icing conditions must not fly under the weather conditions where icing is predicted. Also it is required that pilots be instructed to fasten their seat belts and other safety equipment and that the ELT be installed and operated appropriately.

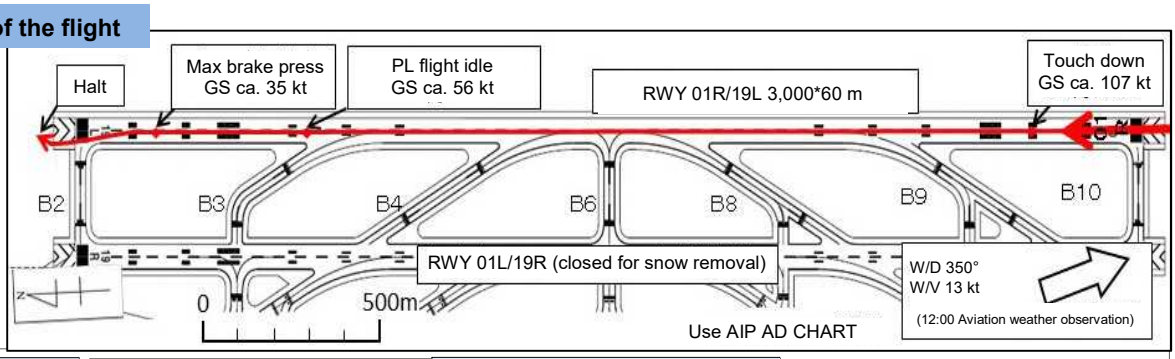
Overran and stopped on a snow-covered grassland

BOMBARDIER DHC-8-402, JA461A

Summary of the Serious Incident: On Thursday, January 19, 2017, a Bombardier DHC-8-402 registered JA461A, operated by ANA Wings CO., LTD. took off from Akita Airport as a scheduled flight 1831 of ALL NIPPON AIRWAYS CO., LTD. as the joint undertaking for transport with ANA Wings, overran and came to a halt at the snow covered grassland at around 11:58 Japan Standard Time (JST: UTC +9 hours, all times are indicated in JST on a 24-hour clock) when landing at New Chitose Airport.

Investigation results

History of the flight



Medium (Values measured by Bombardier with FDR, etc.)	Medium to good (Values measured immediately after the incident occurrence)	Good (Values measured immediately after the incident occurrence)	Good (Values measured immediately after the incident occurrence)

Braking action during braking maneuver

It is probable that the conditions around the end of the runway and overrun area, such as snow coverage, was poor.

* "Braking action" is the classification of friction factor on runways using the terms "Good", "Medium to Good", "Medium", "Medium to Poor", "Poor", or "Very poor" from large values.

Aircraft that overran

Condition of runway on the north side

Condition of runway on the south side

Delay in the start of braking by the captain

- It is highly probable that the captain, who was instructed by the air traffic controller to vacate from taxiway B2 at the end of runway, tried to vacate the runway in a short time by delaying the braking operation start and high speed rolling on the runway.
- The incident is contributed to the captain's judgment failure of Taxiway B3 where he just started to vacate as Taxiway B4.

Operation of power lever (PL)
(Failure to obtain sufficient braking force required for deceleration because the PL was not set to the Disc position during the time from touchdown to stop of the aircraft

- It is probable that the PIC mistook the PL position during the time from touchdown to stopping of the aircraft and did not check it in the meantime.
- It is probable that the co-pilot did not realize that the intentions of the captain differed from his own.

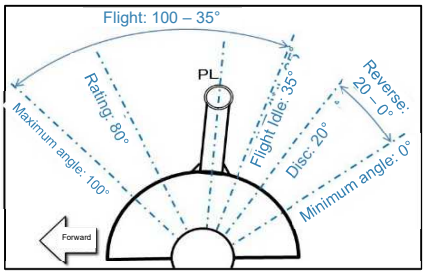


Figure 2. PLA

Probable Cause (excerpt): In this serious incident, it is highly probable that the aircraft overran the runway because the aircraft could not obtain the braking force due to the delay of braking operation start by the PIC and PL (Power Lever) was not set at the Disc position. Moreover, it is somewhat likely that the bad conditions with snow fall around the end of the runway and the overrunning zone contributed to the aircraft overrunning.

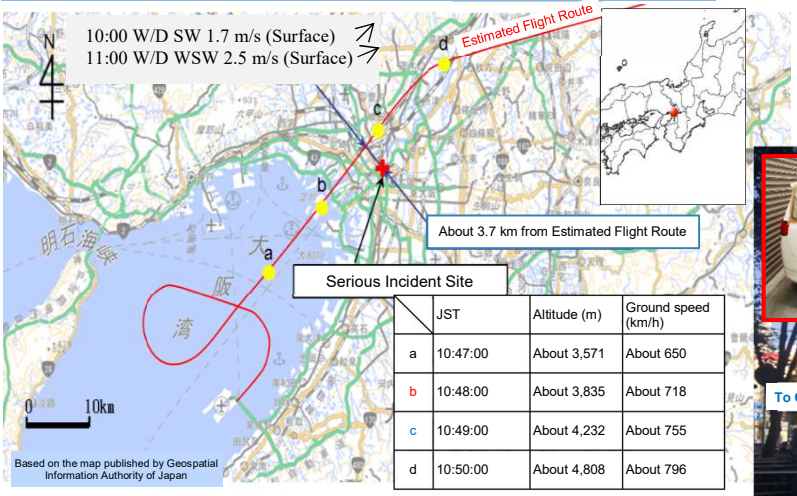
For details, please refer to the accident investigation report. (Published on February 22, 2018)
http://www.mlit.go.jp/jtsb/eng-air_report/JA461A.pdf

Parts fallen from aircraft hits vehicle on the ground
KLM ROYAL DUTCH AIRLINES BOEING 777-200, PH-BQC

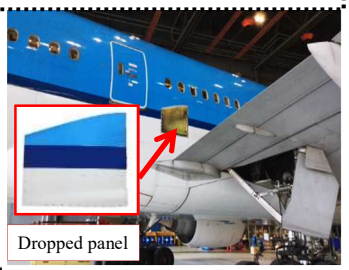
Summary of the Serious Incident: On Saturday, September 23, 2017 a Boeing 777-200, registered PH-BQC, and operated by KLM Royal Dutch Airline, took off from Kansai International Airport for Amsterdam Schiphol International Airport on a scheduled Flight 868 of the Operator. A right aft wing-to-body fairing panel was dropped from the aircraft climbing while accelerating over Osaka city. The dropped fairing panel collided with a vehicle driving on a road in Kita-ku, Osaka City.

Investigation results

Circumstances of the flight and falling parts



	JST	Altitude (m)	Ground speed (km/h)
a	10:47:00	About 3,571	About 650
b	10:48:00	About 3,835	About 718
c	10:49:00	About 4,232	About 755
d	10:50:00	About 4,808	About 796



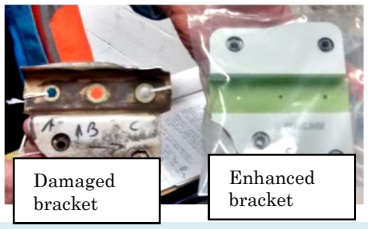
Damage condition of the bracket used and falling panel

○ The bracket (a part for securing the panel to the body) was a pre-enhancement bracket.

- It is probable that the Panel was not fitted tightly to the fuselage.

- The preload that forced the forward upper corner of the Panel down was weak or had weakened due to aging degradation

- Marks caused by fatigue fracture were left on the broken Bracket's fractured surfaces



○ The part had not been replaced with an enhanced bracket.

After the incidents of damaged pre-enhancement bracket and panel dropping, the aircraft's manufacturer issued two service bulletins, but not for the 777-200 aircraft.

Load caused by aerodynamic force from the panel's exterior

Load placed by the air flowing inside the panel

→ Repeatedly acted on the flange part of the bracket as bending stress which resulted in fatigue fracture.

Damage of bracket → A large gap was formed between the forward upper corner of the panel and the fuselage. → Pressure and vibration of inflow air → Panel dropped

Probable Cause: It is certain that this serious incident occurred when the departed right aft wing-to-body fairing panel struck and damaged a moving vehicle, while the aircraft was climbing and passing over the city of Osaka after takeoff.

Regarding the departure of the Panel, it is highly probable that the Bracket that secured the Panel's forward upper corner by holding it to the Aircraft's side broke, a gap was occurred between the Panel's forward upper corner and the fuselage, and the Panel departed due to the pressure of inflowing air and vibration.

For details, please refer to the accident investigation report. (Published on November 29, 2018)
http://www.mlit.go.jp/jtsb/eng-air_report/PHBQC.pdf

Summaries of major railway accident and serious incident investigation reports (case studies)

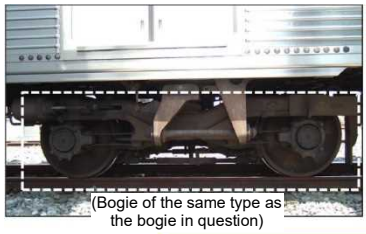
Derailment due to a crack at the side beam of the bogie, leading to the increase of the wheel load unbalance, etc.

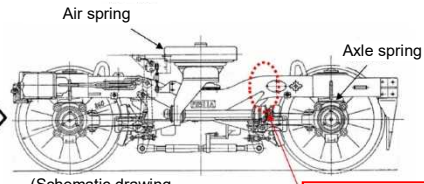
Train derailment, in the premises of Naka-itabashi Station, Tojo Main Line, Tobu Railway Company

Summary: On Wednesday, May 18, 2016, the train, composed of 10 vehicles, departed from Naka-itabashi station on schedule. After the train had operated in powering operation, the driver of the train shifted the notch off to operate in coasting operation until the rearmost vehicle passed the turnout in the premises of Naka-itabashi station.
When the train driver accelerated the train in powering operation again, after the train had passed the turnout, he noticed that the emergency button in the cabin was operated, then applied the emergency brake to stop the train.
After that, the conductor checked the status of outside train and found that all two axles in the rear bogie (the bogie question) of the 5th vehicle were derailed to the right.
There were about 400 passengers, the train driver and conductor onboard the train, but no one was injured.

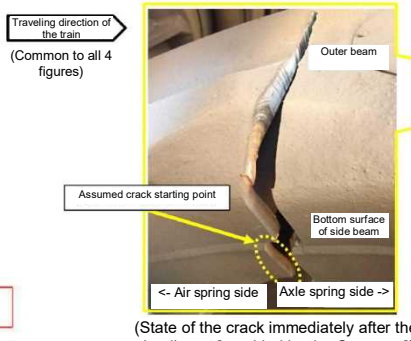
Investigation results

It is probable that, before the derailment, the crack already extended from the bottom plate to around the upper part of the side surface of the side beam in the right side of the bogie, and that the wheel load of the front axle right wheel of the bogie was decreasing, causing wheel load unbalance exceeding the control value.

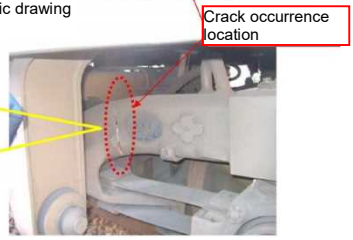

(Bogie of the same type as the bogie in question)



(Schematic drawing of bogie)

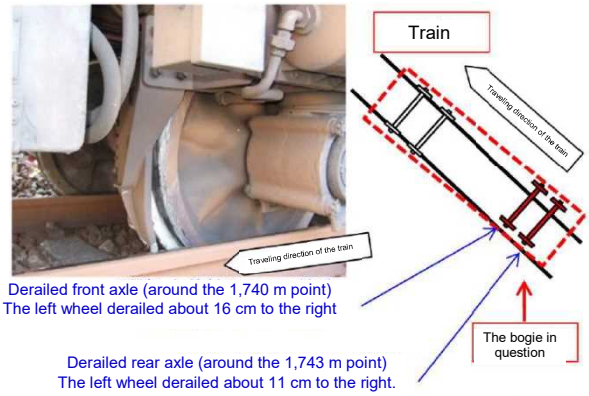


(Common to all 4 figures)
(State of the crack immediately after the derailment [provided by the Company])



(Crack occurrence location on the bogie)

It is probable that, because in this state the 5th vehicle entered the left curving track of 178 m radius, the lateral force of the front axle right wheel of the bogie in question increased, causing the wheels to climb up the right rail of the curve.



Based on the facts that oil-like substance was adhered on the right rail up to the rear axle gear case of the bogie in question and that the gear case was damaged, it is probable that the train was running while the gear case kept in contact with the right rail.

The conductor of the train told that he noticed a burnt odor and white smoke after the occurrence of the accident. Concerning the burnt odor, it is probable that the odor was generated when the oil leaking from the damaged gear case evaporated due to the heat caused by the contact between the gear case and the rail. Concerning the white smoke, it is probable that the smoke was generated because of the derailed wheels running on the PC sleepeers and ballasts, since the smoke had disappeared when the conductor made a check.

Probable Causes (excerpt): It is probable that the right wheel of the front axle in the rear bogie in the 5th vehicle of the train climbed up the right rail and derailed to right, because the wheel load unbalance had been enlarged as the wheel load of the right wheel of the front axle had decreased due to the crack, existing from the bottom plate to upper part of the side surface of the side beam in right side of the rear bogie, and the lateral force of the right wheel of the front axle had increased when the rear bogie had entered the left curved track of 178 m radius, in the accident.

For details, please refer to the accident investigation report. (Published on January 25, 2018)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-1.pdf

Derailment due to gauge widening caused by failures of sleepers and rail fastening devices

Train derailment, between Hanawa station and Mizunuma station, Watarase Keikoku Line, Watarase Keikoku Railway Co., Ltd.

Summary: On May 22, 2017, the driver of the train, the electric and track inspection cars composed of three vehicles, felt a shock just after the train had passed through the 160 m radius right curved track, between Hanawa station and Mizunuma station, at about 36 km/h, then applied an emergency brake to stop the train.
After the train had stopped, the driver checked the situation and found that all axles in the front bogie of the 2nd vehicle had derailed to left.
There were 7 persons, i.e., the train crews and the staff in charge of railway facilities etc., onboard the train, but no one was injured.

Investigation results

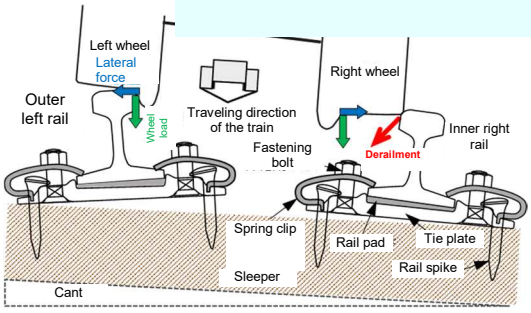
At around the starting point of derailment, failures of sleepers were continuing and the lifting of rail spikes of the rail fastening devices was continuously occurring.

The irregularity of gauge at around the starting point of the derailment measured just before the occurrence of the accident significantly exceeded the maintenance standard value.

It is desirable to develop a management system to ensure reliable checks and maintenance for sleeper corrosion, rail spike lifting, etc.
Measures are required to give priority to maintenance in the case of continuous occurrence of sleeper corrosion, rail spike lifting, etc. and for sharp curves with a large slack.

It is desirable to determine the maintenance deadline, etc. in case that the track irregularity exceeds the maintenance standard value, to ensure that track maintenance is reliably implemented. Also, it is desirable to determine how to handle the operation rules and track maintenance, etc. in the case that significant track irregularity is found during track inspection/measurement, so that they can be reliably implemented.

It is desirable to replace wooden sleepers with sleepers made of concrete or equivalent materials, which have higher durability and maintainability than wooden sleepers (including partial replacement where every several sleepers are replaced).



Probable Causes: It is probable that the accident occurred as the right wheel in the 1st axle of the front bogie of the 2nd vehicle fell off to the inside of the gauge and continued running being spread gauge, and then the left wheel flange in the front bogie climbed up to outer left rail and derailed to left, because the gauge was widened while the train, the electric and track inspection cars, was passing in the 160 m radius right curved track.

It is probable that the gauge widening was caused by the rail tilting etc., due to lateral forces accompanied with train running in the curved track where the continuous defective sleepers and rail fastening devices were existed.

It is somewhat likely that the existence of significantly large gauge widening to cause derailment was related with that the proper track maintenance had not been implemented because the danger against gauge widening by the continuous defective sleepers and rail fastening devices had not been recognized in the periodic inspection etc., and the proper operation control and the track maintenance had not been implemented even though the remarkably large irregularity of gauge had been detected in the measurement by the track inspection cars just before the accident.

For details, please refer to the accident investigation report. (Published on June 28, 2018)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-4-1.pdf

Regarding the fact that four train derailment accidents occurred due to gauge widening, including this accident, between October 2016 and May 2017, the Japan Transport Safety Board has stated opinions to the Ministry of Land, Infrastructure, Transport and Tourism.
For details, please refer to “Chapter 1: Summary of recommendations and opinions issued in 2018 (page 62)”.

For the occurrences of train derailment accidents due to gauge widening, there are factors common to the local railroads with severe business conditions. To prevent such accidents, the followings are effective: (1) to pay attention to the continued failures of sleepers, etc. in the track maintenance and pay particular attention to sharp curves with a large slack; (2) to determine the track maintenance standard value with the safety limit taken into consideration and clarify the maintenance deadline; (3) to replace the sleepers with concrete sleepers that have a superior durability and can reduce the burden of maintenance. For the track maintenance, understanding the track conditions using dynamic track irregularity measurement is effective. It is desirable to facilitate the cost reduction and widespread of track condition monitoring equipment with commercial trains, the practical use of which is currently being promoted.

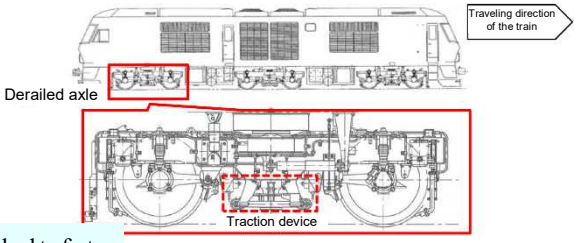
Derailment after the fitting bolts, etc. separated, causing the traction device to hang down and hit the lead rail
Train derailment, in the premises of Kita-Irie signal station, Muroran Line, Japan Freight Railway Company

Summary: On February 23, 2017, the outbound freight train, composed of 19 vehicles, departed from Goryokaku station on schedule. While the train was running in the premises of Kita-Irie signal station at about 54 km/h, the driver of the train stopped the train by the emergency brake as he felt abnormal vibration, and operated the train protection radio. After he had reported the situation to the train dispatcher, he checked the vehicles and found that the 5th and 6th axles in total six axles of the front, middle and rear bogies of the 1st vehicle, i.e., the locomotive, had derailed to right side of the direction of the train. Then, he reported the situation to the train dispatcher.

There was the driver onboard the train, but he was not injured.

Investigation results

It is probable that the traction device broke because the device hit the left guard rail in the Iriechou level crossing after the vehicle parts, such as the fitting bolts and retainers, fell away during running and the traction device hung down.



It is possible that the tightening torque was insufficient for both two bolts attached to fasten the center pin and traction device.

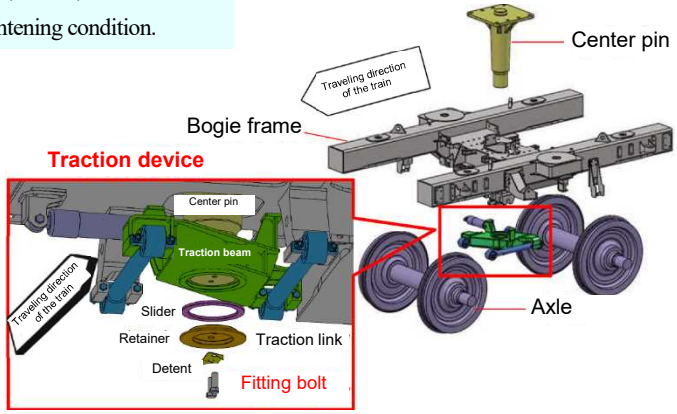
It is probable that, as a result, the fitting bolts fell away due to vibrations, etc. during train running.

Concerning the insufficient tightening torque of the fitting bolts, it is somewhat likely that the workers finished the important parts inspection before fastening the fitting bolts with the specified tightening torque (i.e. leaving the bolts fastened only temporarily), and that the fitting bolts came looser due to vibration etc., during the subsequent train running.

Traction device (damaged)

It is somewhat likely that the workers finished the work before fastening the fitting bolts with the specified torque because, among others, the work procedures, including the task assignment for each worker and the work result checking method, were not properly clarified for the body-bogie connection work of the important parts inspection, and so, the workers did not use the torque wrench during bolt tightening or checking the tightening condition.

It is possible that the loosening of the bolts could not be found during the operation check or the regular inspection because no measures, such as matching marks, were provided to facilitate the detection of loosening by visual inspection, and also partly because, although a hammering test was performed, the bolts were placed in such a position that changes in the hitting sound were difficult to catch due to the load acting on the bolts.



Probable Causes (excerpt): It is probable that the accident occurred as all axles, i.e., the 5th and 6th axles, in the rear bogie in the 1st vehicle, i.e., the locomotive, of the freight train derailed because the traction device had hung down due to the removal of two fitting bolts fastening the center pin and the traction device in the rear bogie during running operation, following the process described in below.

(1) The left traction link broke when the traction device hit the left guard rail in the Iriechou level crossing.

(2) The wheels in all axles, i.e., the 5th and 6th axles, in the rear bogie derailed to right due to the lateral force in right direction acted on the traction device, as the traction device, hanging more after broken, hit the lead rail of the turnout in the premises of Kita-Irie signal station.

It is somewhat likely that the fitting bolts of the traction device fell away because the fitting bolts had come looser due to vibration etc., during train running after finished the important parts inspection, in which the work to connect bogie and vehicle body had finished in the status that the fitting bolts had fastened temporarily, i.e., the fitting bolts had not been fastened with the determined fastening torque.

For details, please refer to the accident investigation report. (Published on July 26, 2018)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-5-1.pdf

Shunting vehicles collided with the car stop and derailed before disturbing the main line, resulting in a minor collision with another shunting vehicle

Heavy property loss without casualties, in the premises of Nogata Station, Chikuho Line, Kyushu Railway Company

Summary: On September 18, 2017, the driver of the shunting vehicles for the inbound Electric 6620M train, composed of two vehicles, started the shunting operation in the route from track 25 to the east lead track No.1 via track 15 in the premises of Nogata station. After that, the vehicles collided with the car stop installed in the end edge of the east lead track No.1 and destroyed it, furthermore, all two axles in the front bogie of the front vehicle derailed to right by the shock and the vehicle body of the front vehicle disturbed the main line in the up track.

As the measures such as train protection etc., accompanied with disturbing main line in the up track had not been implemented, the inbound Electric 6520H train and the shunting vehicles for outbound Deadhead Diesel 1533D train were passing through the disturbed track, and the car side pilot lamp of the shunting vehicle of the outbound Deadhead Diesel 1533D train contacted with the right edge of the front head of the shunting vehicle of the inbound Electric 6620M train and both vehicles were damaged.

There was a driver boarded on the shunting vehicles for the inbound Electric 6620M train and the shunting vehicles of the outbound Deadhead Diesel 1533D train, each, but no one was injured.

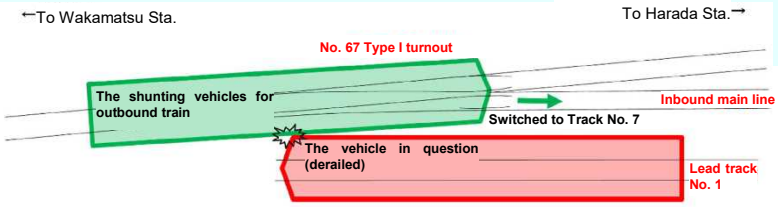
Investigation results

It is somewhat likely that the driver in question temporarily mistook the east leading track No. 2, whose stopping point is located further closer to Wakamatsu Station, for his route.

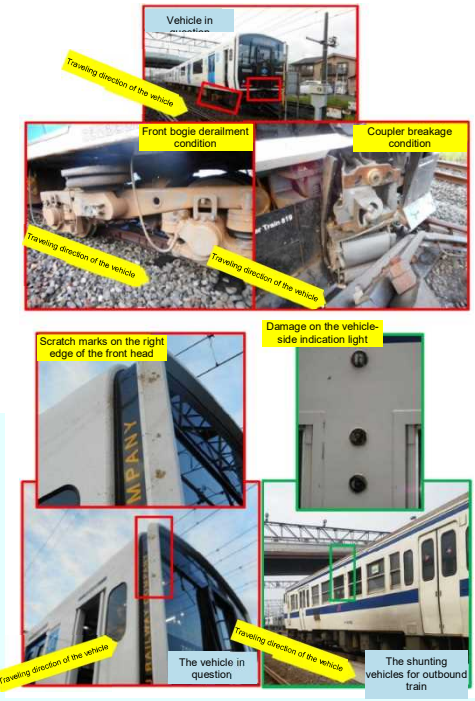
The driver operated the emergency brake only after the vehicle reached about 19 m from the car stop. At this point, the train had passed the target stop position (about 47 m from the car stop).

Based on the above, it is probable that the shunting vehicles collided with the car stop and derailed due to the impact.

It is somewhat likely that, although the driver noticed that the shunting vehicle derailed, he did not recognize the need to take train protection measures because the driver did not feel a large impact when the train collided with the car stop, and so the driver thought that the derailment was not significant and that the situation was not so serious as that the train could disturb the adjacent main line in the up track.



* Concerning the outbound deadhead train, the figure above shows only the first vehicle to describe the contact situation.



It is somewhat likely that the shunting vehicle in question hit another shunting vehicle because the other shunting vehicle had, among others, a larger displacement amount during curve passing than up-trains and also had a large maximum width.

Probable Causes: It is highly probable that the heavy property loss was induced in the railway facilities and the vehicles in the accident, as the vehicle collided with the car stop installed in the end edge of the track because the driver operating vehicles in shunting operation in the premises of Nogata station missed the timing of the braking operation, and the vehicle passing in the main line in the up track contacted with the vehicle derailed by the shock of the collision with the car stop and disturbed the main line in the up track.

It is somewhat likely that the driver missed the timing of the braking operation related with temporary misunderstanding of the shunting route for the other vehicles as the route for his vehicles as he did not concentrate awareness to confirm safety of his route in the shunting operation.

It is probable that the derailed vehicle contacted with the vehicle passing the main line in the up track in relation with that the procedure of train protection was not implemented promptly after the derailment had occurred.

It is somewhat likely that the train protection procedure was not implemented promptly even though the derailed vehicle had disturbed the main line in the up track after the derailment, because the driver of the derailed vehicle had considered that the derailed vehicle was not in the situation as to disturb the neighboring main line in the up track as the deviation was not so large, although he had noticed the fact of the derailment.

For details, please refer to the accident investigation report. (Published on July 26, 2018)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-5-2.pdf

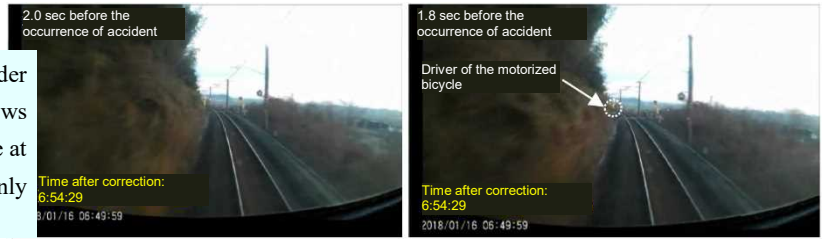
Train collided with a motorized bicycle entering a class 4 level crossing

Level crossing accident, between Idagawa and Kasado Stations, Kansai Line, Central Japan Railway Company

Summary: On Tuesday, January 16, 2018, while the four-car train was running at about 82 km/h between Idagawa station and Kasado station, the driver of the train noticed the motorized bicycle entering Bozuyama level crossing, class 4 level crossing, then applied emergency brake and sounded a whistle, but the train collided with the motorized bicycle.
The driver of the motorized bicycle was dead in the accident.

Investigation results

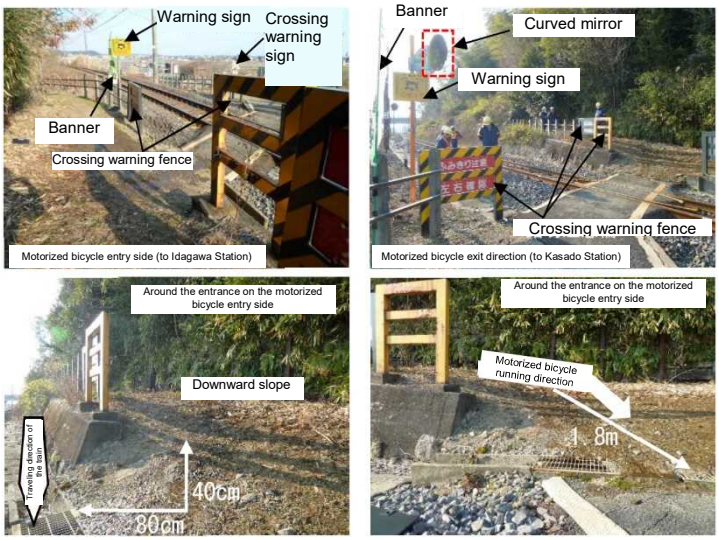
The images captured by the video recorder equipped with the lead vehicle of the train, shows the figure of the driver of the motorized bicycle at around the left-side entrance of the crossing only about 1.8 seconds before the collision.



It was not possible to confirm, from the images of the recorder, that the driver of the motorized bicycle stopped in front of the crossing, or looked at the curved mirror, to check for a train.

It is probable that, although the driver of the train applied the emergency brake, braking could not prevent the collision because the motorized bicycle entered the crossing only 1 to 2 seconds before the collision.

Concerning the visibility during passing of the inbound train, the front marker light of the train would start to be seen on the curved mirror only about 7 seconds before the train reached the crossing. If directly seen with the eyes, the train would start to be seen about 2.5 seconds before the train reached the crossing, due to the land features, etc. Based on the above, it is considered that this crossing is in a state where one will find it difficult to secure enough time from when one notices that a train is coming until when the train arrives.



Probable Causes: It is probable that the accident occurred as the train collided with the motorized bicycle at Bozuyama level crossing, class 4 level crossing without automatic barrier machine nor road warning device, because the motorized vehicle had entered the level crossing in the situation that the train was approaching.
It could not be determined the reason why the motorized bicycle had entered the level crossing in the situation that the train was approaching, because the driver of the motorized bicycle was dead in the accident.

For details, please refer to the serious incident investigation report. (Published on September 27, 2018)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-6-1.pdf

Class 4 level crossings without automatic barrier machines nor road warning devices should be abolished or be provided with crossing security equipment. Concerned parties, such as railway business operators, road administrators (local governments) and local residents, should actively hold talks for that purpose to determine a policy as soon as possible and proceed with concrete efforts. However, there are cases where the talks take long time, during which another accident may occur. JTSB will work to provide information useful to eliminate class 4 level crossings as early as possible, by investigating and analyzing concrete cases associated with the elimination of class 4 level crossings, including providing nearby class 1 level crossings with a sidewalk to improve safety of pedestrians, and abolishing dangerous class 4 level crossings.

Summaries of major marine accident investigation reports (case studies)

A Fire Broke Out and Spread from a Vehicle on a Ferry, One Crew Member Died and the Ship was Abandoned

Fire on Passenger Ferry SUN FLOWER DAISETSU

Summary: While **passenger ferry SUN FLOWER DAISETSU (the Vessel, 11,401 gross tons)** with the Master, 22 crew members, 71 passengers and load of 160 vehicles on board left Oarai Port, Oarai Town, Ibaraki Prefecture, sailing north off to the south of Tomakomai Port, Tomakomai City, Hokkaido, toward Tomakomai Port at around 17:10 on July 31, 2015, a fire broke out on the 2nd deck.

The fire spread in spite of firefighting efforts by the crew, and the Master ordered everyone to abandon ship. All the passengers and crew except a 2nd Officer were rescued by a passenger ferry and others that had arrived to provide assistance.

The 2nd Officer, who had been missing, was found on the 2nd deck at around 11:01 on August 3, and was confirmed dead.

After that, the Vessel was towed to Hakodate port, Hakodate City, Hokkaido, and firefighting by injection of carbon dioxide gas was conducted. The fire was confirmed extinguished at around 14:53 on August 10.

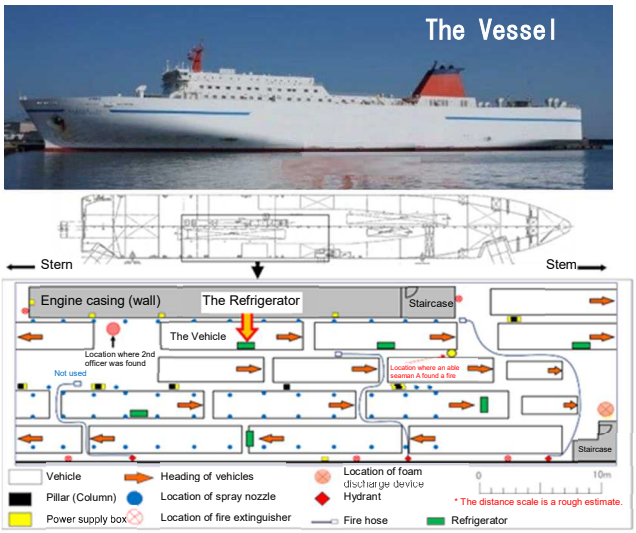
The Vessel has damage from the fire on the center of the starboard deck on the 2nd to 4th decks and to ship structures like the plating shell, as well as to vehicles loaded on the 2nd and 3rd decks.

At around 17:10 on the bridge, a fire detection device with a location identification function issued a preliminary fire alarm which changed to a fire alarm around 17:13. The crew found that the vicinity of the in-vehicle refrigerating unit (the Refrigerator) on a track (the Vehicle) loaded in the center of the starboard side to the engine casing in the starboard midship on the 2nd deck was glowing orange and a fire spread to the bridge.

The crew tried to extinguish the fire on the 2nd deck with fire extinguishers but were unsuccessful. The fire spread to vehicles loaded adjacent to the starboard of the vessel and the force of the fire increased to spread to the 3rd deck.

The Chief Officer abandoned continuation of firefighting efforts and ordered crew members engaged in firefighting to leave the site, but could not find the 2nd Officer.

Order to leave ship (around 18:30), 2nd Officer died



Situation on the 2nd deck when the Accident occurred)

(Summary of the Analysis (excerpt))

(Factors of the fire)

- It is probable that the fire broke out due to electrical factors such as cuprous oxide propagation exothermic phenomenon, poor contact, or a short circuit due to a motor wiring connection method that is prohibited in the Service Manual of the Refrigerator.

(Firefighting by crew)

- It is probable that the fire could not be extinguished because the origin of the fire was inside the cover of the Refrigerator and the crew could not effectively discharge fire-extinguishing agent to the origin of the fire when the fire was found. It is also probable that the fire had spread to the left side of the Vehicle while some crew were fighting the fire with 16 fire extinguishers without using fire hoses while wearing fireman outfits.
- It is probable that fire extinguishing and prevention of the spread of fire from the Vehicle to the adjacent vehicles by spraying water were not possible because the crew did not take systematic fire-fighting activities and because they did not know enough about the usage of water spray devices to spray the 5 sections that exceeded the capacity of the pressurized water spray pump.

Probable Causes (excerpt): It is probable that the Accident occurred because a fire broke out from the Refrigerator on the Vehicle loaded on the 2nd deck while the Vessel was proceeding north toward Tomakomai Port off to the south of Tomakomai Port and firefighting efforts and prevention of the fire spreading by the crew was not adequate.

It is probable that the crew could not extinguish the fire with fire extinguishers when the fire was found because the origin of the fire was inside the Refrigerator cover and the crew could not spray the fire-extinguishing agent effectively on the origin of the fire.

It is probable that the crew could not extinguish the fire or prevent the spread of the fire appropriately because practical education and training given by Company A to its crew was not sufficient.

For details, please refer to the accident investigation report. (Published on September 27, 2018)
http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-9-1_2015tk0005.pdf

To prevent similar accidents, it is desirable to develop and educate fire-extinguishing activity procedures assuming a fire and to build a system of safe and appropriate fire-extinguishing activities by crew.

Container Ships Entering the Passage to Hanshin Port at Almost the Same Time Collided
Collision between Container Ship ESTELLE MAERSK and Container Ship

Summary of the Accident: While **the container ship ESTELLE MAERSK (Vessel A, gross tonnage: 170,794 tons)**, with the Master, 27 crew members and a pilot on board, was proceeding north toward the South Entrance of Kobe Chuo Passage in the Kobe Section of Hanshin Port under escort by the pilot, and **the container ship JJ SKY (Vessel B, gross tonnage: 9,948 tons)**, with the Master and 21 crew members on board, was proceeding west-northwest toward the South Entrance of Kobe Chuo Passage, the two vessels collided near the South Entrance of Kobe Chuo Passage at around 07:08:54 on June 7, 2016.

The Vessel A sustained abrasion damage on the shell plating of her starboard bow, while the Vessel B sustained a pressure collapse on part of her bridge port-side wing. However, there were no casualties or fatalities on either vessel.、

Vessel A

Pilot A was piloting Vessel A and was informed by Port Radio at around 06:43 that several vessels were due to enter the Passage in the same time band.

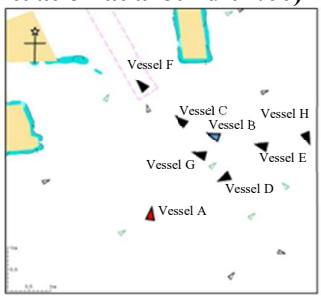
Pilot A thought that Vessel A would be given priority when entering the Passage because (1) Vessel A is a large vessel in the 400m class and (2) he had made a request for the order of Passage entry via Port Radio, and (3) Vessel D accepted this and decided on entering the Passage after Vessel A, he set the main engine to slow ahead at around 07:01 in order to enter the Passage at the scheduled time.

At around 07:03, Master A asked Pilot A about the movement of Vessel B, but did not instruct Pilot A to give way as Pilot A had explained that, as a large Vessel, Vessel A would be given priority by passage control.

Pilot A could not change course to starboard because several vessels on the starboard side were navigating there in succession toward the Passage, and so, with the intention of heading toward the western end of the South Entrance of the Passage on the port side, he instructed rudder 10° to port at around 07:05 followed by rudder 20° to port, then at around 07:06 instructed rudder midships and proceeded north.

Pilot A instructed rudder hard to port at around 07:07:35 and subsequently instructed slow astern followed by full astern, because Vessel B was approaching ahead to starboard.

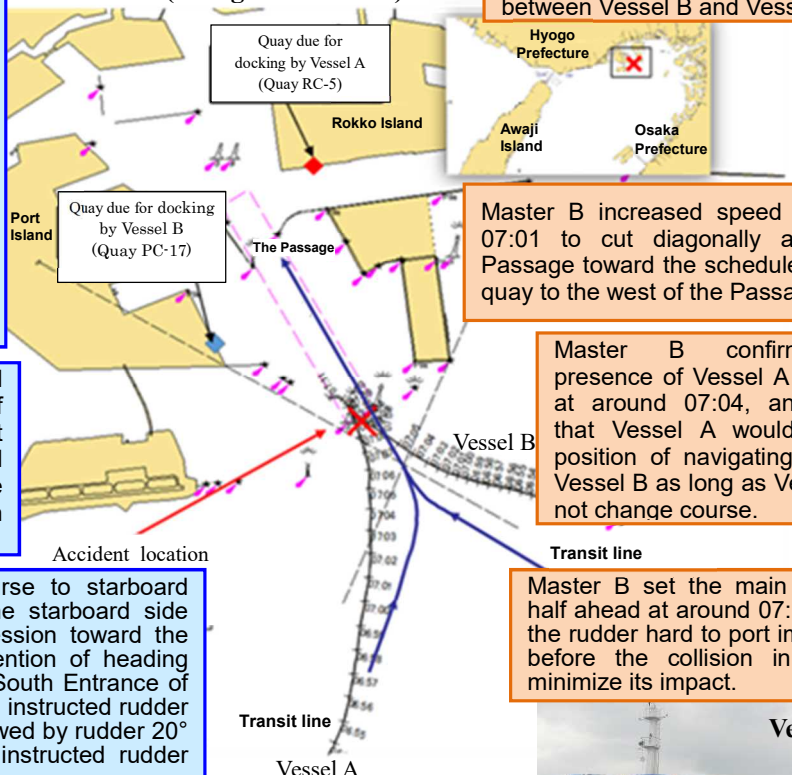
(Situation at around 07:00)



On the Vessel B, Master B and Officer B were keeping lookout by eyesight and radar, and first noticed Vessel A by radar at around 06:50.

Master B thought that Vessel A would navigate astern of Vessel B because he had heard the communication “Follow Vessel B” between other vessels on VHF at around 07:00, and moreover because the distance to Vessel C which was navigating ahead of Vessel B was about 0.3M, and he therefore thought that it would be dangerous for Vessel A to pass between Vessel B and Vessel C.

(Navigation Routes)



Master B increased speed at around 07:01 to cut diagonally across the Passage toward the scheduled docking quay to the west of the Passage.

Master B confirmed the presence of Vessel A with radar at around 07:04, and thought that Vessel A would be in a position of navigating astern of Vessel B as long as Vessel A did not change course.

Master B set the main engine to half ahead at around 07:08 and set the rudder hard to port immediately before the collision in order to minimize its impact.

Collision (at around 07:08:54)

Probable Causes (excerpt): It is probable that this accident occurred because, while the Vessel A was proceeding north and the Vessel B west-northwest toward the Passage in the Kobe Section of Hanshin Port in a state whereby they would both enter the Passage at about the same time, Pilot of Vessel A thought that Vessel A would be given priority when entering the Passage and thus continued to proceed north toward the South Entrance of the Passage, while Master of JJ SKY, thinking that Vessel A would navigate astern of Vessel B, increased speed in an attitude of cutting diagonally across the Passage toward the scheduled docking quay to the west of the Passage, as a result of which the two vessels collided.

For details, please refer to the accident investigation report. (Published on February 22, 2018)
http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2016tk0008e.pdf

Inadequate Installation of Bridge Navigation Watch Alarm System Caused Collision with Another Ship

Collision between Cargo ship GENIUS STAR VIII and cargo ship TOKUHOUMARU No.11

Summary: Cargo ship GENIUS STAR VIII (Vessel A, 9,589 gross tons), with a master (Master A) and 17 other crew members on board, was drifting for time adjustment off to the south-southwest of Cape Ashizuri of Kochi Prefecture, while Cargo ship TOKUHOUMARU No.11 (Vessel B, 498 gross tons), with a master (Master B) and other 4 crew on board, was sailing east-northeast, both vessels collided at around 10:50 on March 24, 2018.

Vessel A sustained a breach on the port rear side-plating and Vessel B had her stem collapsed.

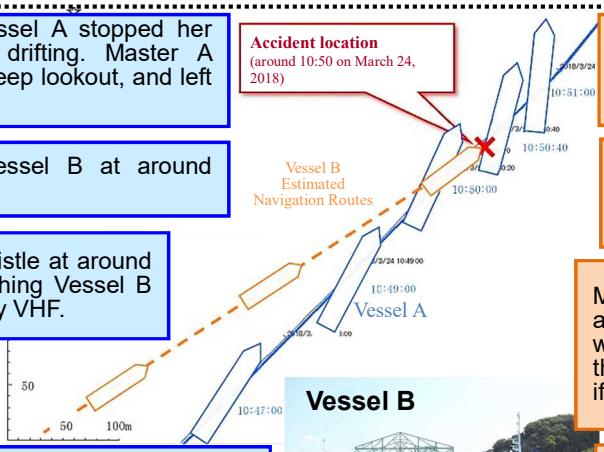
There were no casualties on both vessels.

At around 02:00, Vessel A stopped her engine and started drifting. Master A instructed Officer to keep lookout, and left the bridge.

Officer A noticed Vessel B at around 10:20.

Officer A blew the whistle at around 10:45 to the approaching Vessel B and called Vessel B by VHF.

Hearing the whistle sound of Vessel A, Master A ran up to the bridge and called Vessel B by VHF at around 10:49 along with a continuous whistle. As there was no response from Vessel B, Master A ordered engine personnel on duty to stand by engine.



In Vessel B, Master B alone assumed lookout on the bridge and the vessel was sailing east-northeast at around 14kn with the auto pilot.

As there was good visibility, Master B set the radar to the stand-by condition and kept visual lookout.

Master B confirmed the vessel position at around 10:30, and sat on a chair while on duty with the auto pilot. As he thought that the alarm would work even if he slept, he dosed off due to fatigue.

Woken up by the whistle sound of Vessel A, Master B recognized the port side hull of Vessel A approaching ahead to starboard, and set the propeller pitch to full astern.

Collision (at around 10:50)

Recurrence prevention measures: Any vessel with a watch alarm system shall not put too much confidence in the system and shall try to avoid dozing off at the wheel and (a) keep the system active at all times while sailing, (b-1) check its operating condition extensively at departure, (b-2) adjust sensor mounting angle adequately and (b-3) set the quiescent time to as short a time as possible (3 to 5 min).

Accidents of vessels of 150 gross tons or more with watch alarm system due to dozing off

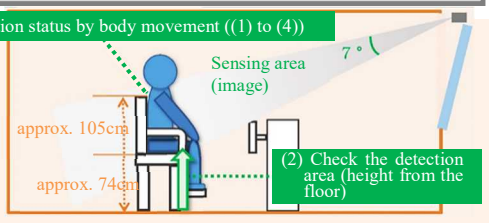
Accidents due to dozing off (since July, 2011)		55 cases
(a) System power OFF		16 cases
(b) Power is ON but no alarm	(1) System failure (2) Sensor detects action (3) Dozing off while the system is quiescent	33 cases

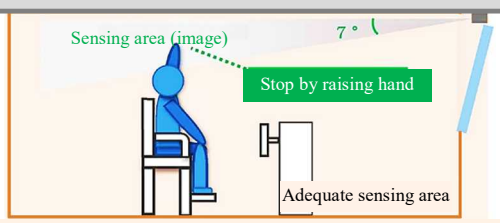
The watch alarm system of Vessel B was set as the alarm would be issued only if the sensor did not detect movement of the watchkeeper for 4 min. As the sensor was oriented to a position lower than the manufacturer recommended mounting location, it is probable that the alarm was not triggered because the sensor detected the movement of the body or leg of Master B.

Adequate sensor angle (recurrence prevention measures against b-2)
For mounting the sensor of the watch alarm system, the sensing area should be adjusted to the position and angle where raising your hand is required to stop the alarm, with the top of the head of watchkeeper as the lowest limit.

(1) Investigate the detection status by body movement ((1) to (4))

(1) If no movement, alarm triggered in around 4 min.
(2) If the head moved, alarm triggered in around 4 min.
(3) If the hand moved, alarm triggered in around 4 min.
(4) If the leg moved, no alarm.





Probable Causes (excerpt): It is probable that this accident occurred because, while Vessel A was drifting for time adjustment off to the south-south west of Cape Ashizuri, while Vessel B was sailing toward east-northeast, Vessel B collided with Vessel A as Master B on duty alone on the bridge fell asleep. It is probable that the system detected the movement of the body or leg of Master B and did not trigger the alarm, which may have caused the accident.

For details, please refer to the accident investigation report. (Published on March 28, 2018)
http://www.mlit.go.jp/jtsb/ship/rep-acci/2019/MA2019-3-2_2018tk0019.pdf

It is necessary to note that systems brought about by new technologies effective for safer navigation do not mean reduction of primary duties required for the bridge watchkeepers, and using the systems adequately so that their performance is fully realized is imperative.

A Fire Broke Out on a Vessel Docked at Hakata Port, Sank and Oil Spill

Fire on Cargo Ship TAI YUAN

Summary of the Accident: At around 13:20 on April 24, 2017, as **the cargo ship TAI YUAN (the Vessel, gross tonnage: 1,972 tons)**, with a master and ten other crew members aboard, was waiting to begin loading of waste metal and other miscellaneous scrap at the No. 16 Berth of Hakozaki Wharf, Hakata Port, Fukuoka City, Fukuoka Prefecture, a fire broke out in the aft cargo hold.

At around 04:54 on the following day, April 25, the Vessel foundered during firefighting and became a total loss. An oil spill occurred, but there were no fatalities or injuries.

From around 09:00 on April 21 to the morning of April 22, the Vessel loaded scrap into her aft cargo hold and fore cargo hold, and in the afternoon, the Vessel loaded scrap into her fore cargo hold.

At around 08:00 on April 24, the Vessel began loading the scrap into the fore cargo hold and work was then discontinued at around 12:00, at which point the fore cargo hold had been loaded to approximately 80% and the aft cargo hold had been loaded to around 50%.

One of the workers of the shipper and loading business (Company A) saw a small amount of white smoke rising from within the scrap in the port aft section of the aft cargo hold at around 13:20.

The Vessel's crew members and Company A's workers conducted firefighting efforts by spraying water using fire hoses connected to the Vessel's fire hydrants and a water truck.

The Fire Company arrived at the Vessel, took over firefighting, and used a firefighting tactic centered on protein foam spraying, and as it prepared for the spraying, it sprayed water at the aft cargo hold and plating shell to suppress the force of the fire.

• The Vessel listed to port and the fire spread to the fore cargo hold.

• While observing the circumstances of the Vessel's listing and foundering and the fire's force, the Fire Company continued protein foam spraying and spraying water into the cargo holds and spraying cooling water onto the plating shell; however, it could not extinguish the fire and the fire's force did not abate.

The Vessel foundered from her port bow side. She settled on the bottom with only her wheel house above the water. The fire was extinguished (at 04:54 on April 25).

Circumstances of the fire of the vessel

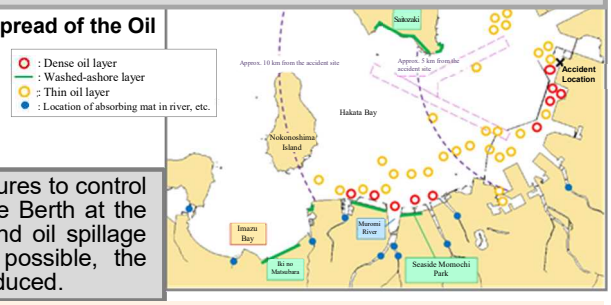
(Circumstances Leading up to the Fire)

It is somewhat likely that a spark created by contact between metal objects, a battery, etc., in the scrap was the source of the fire, and that the source ignited insulation material, plastic, rubber, vinyl, wood chips, pieces of paper, or combustible material mixed in the scrap.

(Analysis of the Spread of Fire and the Vessel's Foundering)

- It is probable that the insulation material and other combustible items with low specific gravity floated in a burning state even when the water level in the cargo holds rose due to the continuous spraying of water and continued to burn on the water's surface.
- It is probable that the fire spread when combustible material in the fore cargo hold caught fire because the combustion heat of the aft cargo hold passed through the bulkhead and to the fore cargo hold.
- It is probable that the Fire Company continued spraying water into the cargo holds while observing the circumstances of the Vessel's listing and foundering and the fire's force because it thought that it could not reduce the danger that fuel oil would ignite and burn.
- It is probable that the effect of water accumulated in the cargo holds led to the Vessel's foundering from her port bow side because no damage that could cause flooding had occurred.

The Spread of the Oil



(Analysis of Measures to Reduce Damage caused by Spreading Oil)

It is somewhat likely that had the readiness to implement measures to control oil, such as deploying oil fences and other equipment near the Berth at the time that the possibility the Vessel would founder emerged and oil spillage was anticipated been developed to the maximum degree possible, the amount of damage caused by spreading oil could have been reduced.

Probable Causes (excerpt): It is probable that the accident occurred when, as the Vessel was moored for the purpose of cargo-handling at Hakata Port, a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using the Vessel's carbon dioxide gas firefighting equipment were not employed.

It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment.

It is probable that the Master did not think of using the carbon dioxide gas firefighting equipment because he did not have experience with fire drills for a fire in the Vessel's cargo holds and because the Vessel and Company A did not share information on effective firefighting methods for times of fire.

For details, please refer to the accident investigation report. (Published on October 25, 2018)
http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2017tk0007e.pdf

A Passenger Ship Hit a Light Beacon, 25 Passengers Seriously or Slightly Injured

Passenger ship SORA contacted with an approach light beacon

Summary: Passenger ship SORA (the Vessel, 84 gross tons) with its master (Master), chief engineer and 29 passengers on board, left the Kaijo Access Terminal in Senshu Port, sailing north toward a pier of Kobe Airport Kaijo Access Terminal (the Pier) in Kobe Section No.5 of Hanshin Port, collided against the east approach light beacon (the Approach Light Beacon) of Kobe Airport in Hanshin Port, Kobe Section No.6 at around 21:29 on July 26, 2017.

The Vessel had 4 passengers seriously injured, 21 passengers and 2 crew members slightly injured, and the stem on the port-side of the ship collapsed. The Approach Light Beacon had scratches on the base.

The Vessel started navigation to the north at approx. 27 kn at around 21:04:53 with manual steering by the Master.

At around 21:05:49, the steering was switched from the Master to Chief Engineer, and the Chief Engineer changed the course to the port side, trying to avoid two vessels passing ahead of the Vessel.

The Master, having entrusted the steering to the Chief Engineer, while chatting and using a smart phone, kept navigation at around 27 kn.

After two vessels had passed ahead of the Vessel at around 21:11:52, the Chief Engineer continued sailing north toward the light of the signal from the Kobe No.2 signal house.

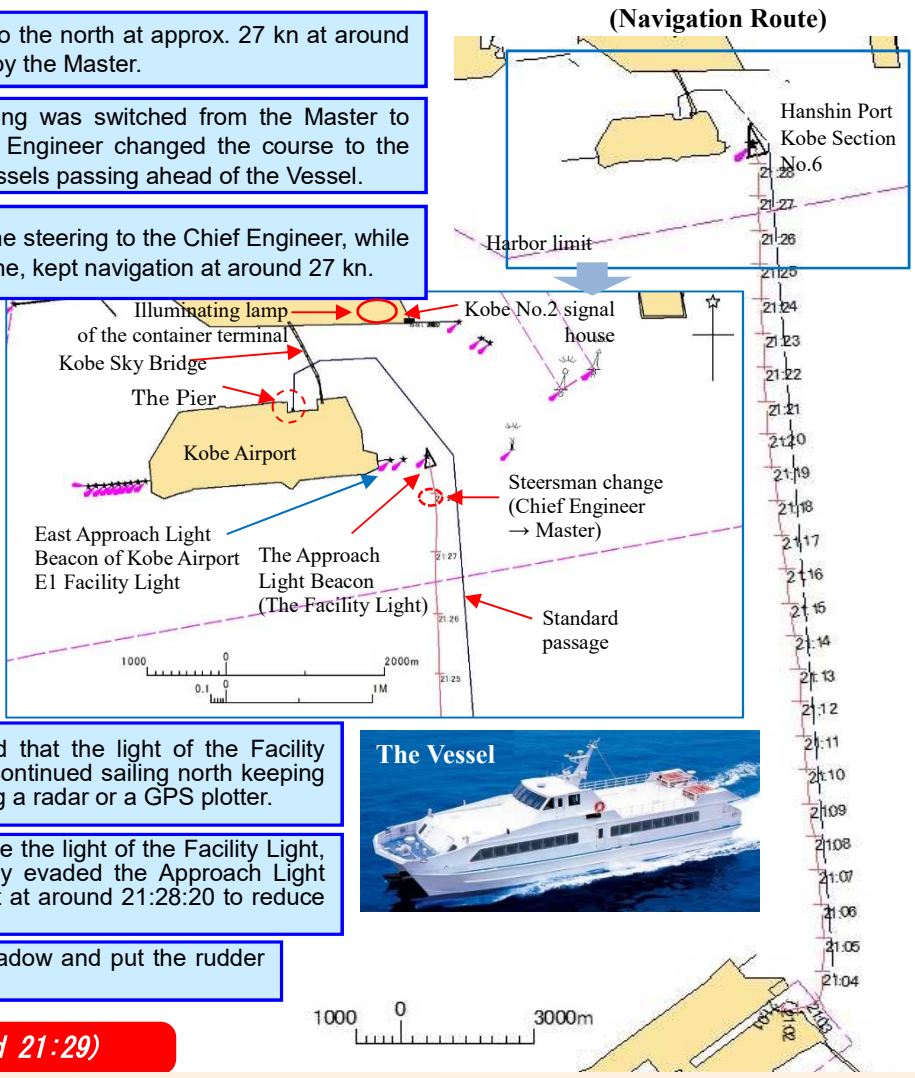
After the Chief Engineer had steering taken over by the Master at around 21:27:52 without giving information on the East Approach Light Beacon E2 Facility Light of Kobe Port (the Facility Light), he was checking entries in the engine log book.

Though the Master understood that the light of the Facility Light is hard to recognize, he continued sailing north keeping only visual lookout without using a radar or a GPS plotter.

As the Master could not observe the light of the Facility Light, he thought that he had already evaded the Approach Light Beacon, and he steered to port at around 21:28:20 to reduce the navigation distance.

The Master noticed a black shadow and put the rudder hard to starboard.

Collision (at around 21:29)



Probable Causes (excerpt): It is probable that the Vessel collided with the Approach Light Beacon because the Master did not notice that the Vessel was proceeding toward the Approach Light Beacon as the Master kept only visual lookout without using a radar and GPS plotter while the Vessel was sailing north in Kobe section of Hanshin Port toward the Pier, under the condition where the light of the Facility light was hard to observe at night due to the masking of the light of the container terminal in the Port Island behind the Facility Light.

It is probable that Master did not use a radar and a GPS plotter because he had been chatting with the chief engineer and he could have observed the Approach Light Beacon till then if he came near the beacon.

For details, please refer to the accident investigation report. (Published on December 20, 2018)
http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-12-1_2017tk0010.pdf

JTSB had made recommendations to OM KOBE CO., LTD. for securing transportation safety.
For details, please see Chapter 1 “Summary of recommendations and opinions issued in 2018” (page 56).

To prevent similar accidents, it is desirable to make the contents of Safety Management Rules fully known by the crew, to keep adequate lookout all the time, to educate them on the importance of navigating standard routes, and to train them on adequate ship handling.

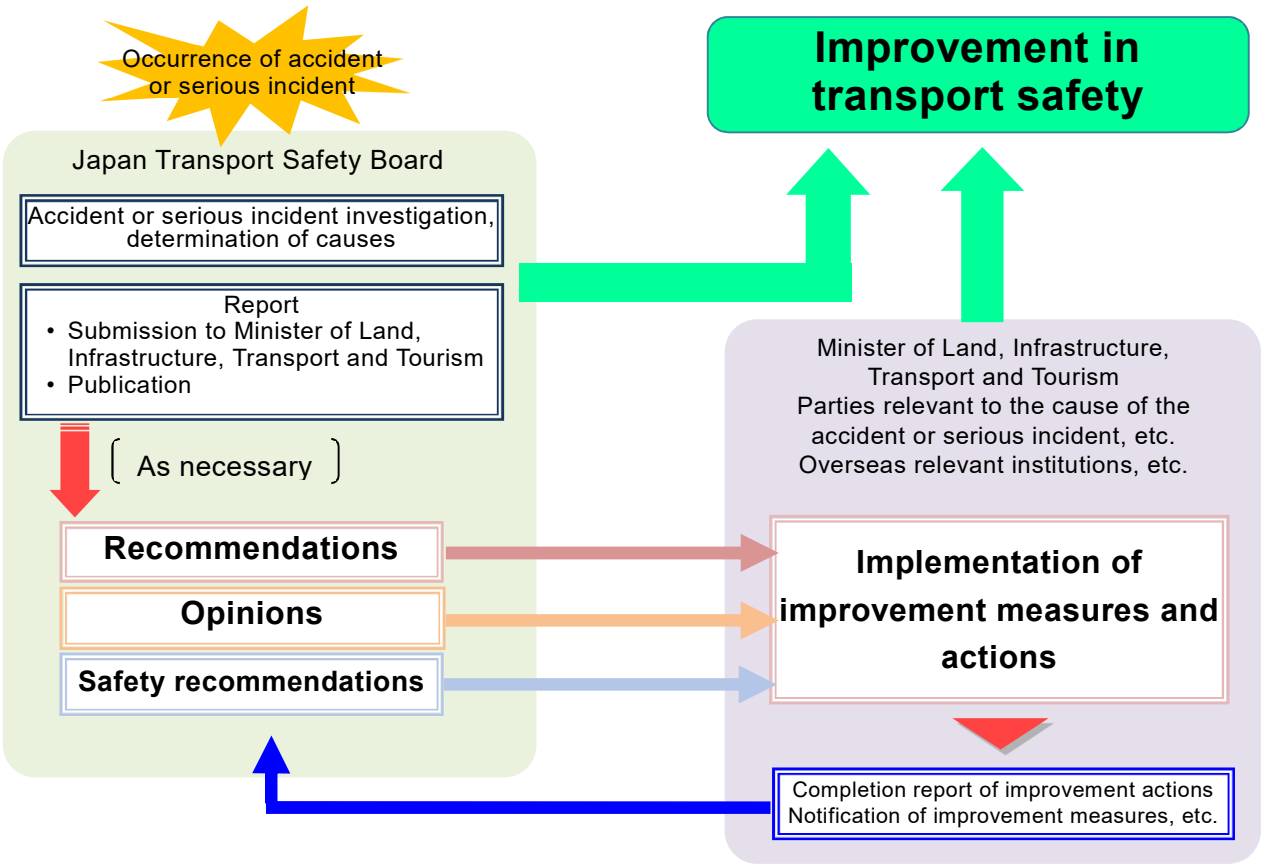
Chapter 1 Summary of recommendations and opinions issued in 2018

In order to fulfill the objectives of the law specified in Article 1 of the Act for Establishment of the Japan Transport Safety Board (hereinafter referred to as "Establishment Act"), the Japan Transport Safety Board has been established as an external bureau of the Ministry of Land, Infrastructure, Transport and Tourism based on the regulations of Paragraph 2, Article 3 of the National Government Organization Act (Article 3 of the Establishment Act). Its duty is to accurately conduct investigations identifying the causes of aircraft, railway, and marine accidents and serious incidents, as well as the causes of damage occurring due to those accidents and serious incidents, while also requesting required measures and actions to be taken by the Minister of Land, Infrastructure, Transport and Tourism or parties relevant to the causes of accidents or serious incidents, based on the results of its investigations (Article 4 of the Establishment Act).

Specifically, the Japan Transport Safety Board has the ability to give recommendations to the Minister of Land, Infrastructure, Transport and Tourism or parties relevant to the causes of accidents or serious incidents, regarding measures that should be taken for the prevention of accidents or serious incidents, or for reducing their damage, based on the results of its accident investigations. The Minister of Land, Infrastructure, Transport and Tourism must provide notifications to the Japan Transport Safety Board on measures that have been taken based on its recommendations, and if parties relevant to the causes of accidents or serious incidents do not take measures in response to recommendations that have been given, the Japan Transport Safety Board has the ability to publicly disclose that fact (Articles 26 and 27 of the Establishment Act).

In addition to actions based on individual accident investigation results, if it is recognized to be necessary at an interim stage of investigations or from investigation results of multiple past accidents, the Japan Transport Safety Board has the ability to state its opinions to the Minister of Land, Infrastructure, Transport and Tourism or the directors of related government institutions regarding measures that should be taken to prevent accidents or serious incidents and to reduce their damage (Article 28 of the Establishment Act).

In the cases of aircraft and marine accidents and serious incidents, the Japan Transport Safety Board may provide recommendations (safety recommendations) on measures that should be taken quickly in order to improve safety, to related overseas institutions or parties as necessary in any stage of accident investigations, based on international treaties.



The recommendations and safety recommendations issued by the Japan Transport Safety Board in 2018 are summarized as follows.

1 Recommendations

(1) Aircraft accident involving a CESSNA 172P (small aeroplane), registered JA3989, operated by New Central Airservice Co., Ltd.

(Recommendations on August 30, 2018)

Summary of the Accident

On Saturday, June 3, 2017, a Cessna 172P, registered JA3989, operated by New Central Airservice Co.,Ltd., took off from Toyama Airport, while flying to Matsumoto Airport, at around 14:50 Japan Standard Time (JST: UTC+9 hours, unless otherwise stated all times are indicated in JST), it crashed into the vicinity of the top of Mt. Shishi-dake (elevation about 2,700 m) in the Tateyama Mountain Range.

There were four people on board the Aircraft consisting of a PIC, a pilot and two passengers and all of them were fatally injured.

The aircraft was destroyed but there was no outbreak of fire.

Probable Cause

It is probable that as the Aircraft got into clouds during VFR flight over the mountain region, it became difficult for the PIC and the Pilot to grasp its own position and surroundings by confirming visually the terrain, then, the Aircraft approached the vicinity of the mountaintop and crashed into it.

It is somewhat likely that the Aircraft approached the vicinity of the mountaintop and crashed into it due to loss of visual contacts making the crash unavoidable, or due to failure to maintain minimum safe altitude caused by the Aircraft icing or stalled condition, or due to encountering a severe turbulence. However, it could not be determined, since the PIC and all members on board were fatally injured.

Concerning the fact that the Aircraft came to fly into clouds, it is probable that the PIC and the Pilot had not confirmed thoroughly the weather forecast for the mountainous region before departure and they delayed in making a decision to turn back during flight.

Recommendations to the Minister of Land, Infrastructure, Transport and Tourism

In view of the result of this accident investigation, the Japan Transport Safety Board recommends pursuant to the provision of Article 26 of the Act for Establishment of the Japan Transport Safety Board that the Minister of Land, Infrastructure, Transport and Tourism should take the following measures in order to prevent the aircraft accidents and reduce damage from those when they occur.

(1) Make it known to pilots that the icing conditions are extremely hazardous for the aircraft not certificated for flight in icing conditions and those aircraft should definitely avoid flying in icing conditions.

(2) Encourage pilots for small aeroplanes to fasten their seat belts and shoulder harnesses and instruct them to ask their passengers to fasten their seat belts.

(3) Provide small aeroplane users with the information on the appropriate installation and operation of the ELTs.

(4) Request relevant organizations to ensure that each search and rescue (SAR) aircraft during SAR operation shall be able to precisely listen on the distress frequencies.

(2) Contact with an approach light beacon involving the passenger ship SORA

(Recommendations on December 20, 2018)

Summary of the Accident

At around 21:29 on July 26, 2017, the passenger ship SORA, with a master and chief engineer serving as crew and 29 passengers on board, was proceeding north toward the pier of the Kobe Airport Kaijo Access Terminal in Kobe Section No. 5 of Hanshin Port after departing from the Kaijo Access Terminal of Senshu Port when she collided with the Kobe Airport East Approach Light Beacon in Kobe Section No. 6 of Hanshin Port.

Four of SORA's passengers were seriously injured and 21 passengers and two crew members received slight injuries, and the port hull and bow sustained crush damage and other damage. Additionally, the Kobe Airport East Approach Light Beacon sustained abrasions and other damage to its supports.

Probable Causes

It is probable that the accident occurred when, as the passenger ship SORA was proceeding north in the Kobe section of Hanshin Port toward the pier of Kobe Airport Kaijo Access Terminal, which is in Kobe Section 5 of Hanshin Port, at night under conditions in which the light of the E2 light on the Kobe Airport East Approach Light Beacon was difficult to see due to the light of flood lights of Port Island's container terminal, which was behind the light beacon, SORA collided with the light beacon when her master did not notice that she was heading toward the light beacon because he was keeping visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images.

It is probable that the master was keeping visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images, because the master was continuing to chat with the chief engineer and because he had been able to visually observe the light of the Kobe Airport East Approach Light Beacon's E2 light whenever he approached the light beacon in the past.

It is probable that the points that master had entrusted steering to the chief engineer, was operating a smartphone, was continuing to chat with the chief engineer, and was keeping visual lookout only without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images; that the master had weak awareness in terms of returning to the standard route and was navigating on the western side of the standard route without indicating the standard route on the GPS plotter that overlaid the radar's image; and that the chief engineer passed steering to the master without sharing information on the light beacon's E2 light and subsequently was checking

items noted in the engine logbook and not keeping lookout toward the bow meant that discipline was not being maintained in SORA's wheelhouse, and it is probable that such circumstances contributed to the accident's occurrence.

Given that OM Kobe Co., Ltd. did not clearly indicate and make known specific information concerning ordinary navigational watch stations that are required by stipulations in safety management regulations, and that sufficient safety education and training on the importance of keeping appropriate lookout using the radar installed on the port side of the steering stand and GPS plotter that overlaid the radar's image, sharing information among crew members, and navigating on the standard route whenever possible had not been provided, it is probable that wheelhouse discipline was not being maintained aboard SORA because OM Kobe Co., Ltd.'s safety management was not functioning effectively, and it is probable that such circumstances contributed to the accident's occurrence.

Regarding the occurrence of many injured passengers, including some who suffered serious injuries, it is probable that this was because many of the passengers were not using seatbelts.

Additionally, it is somewhat likely that the point that, when passengers were thrown toward the bow, they hit the seats in front of them and the seats separated from the floor and fell over contributed to the spread of damage.

Recommendations to the OM Kobe Co., Ltd.

It is probable that the accident occurred when, as the passenger ship SORA was proceeding north in the Kobe section of Hanshin Port toward the pier of Kobe Airport Kaijo Access Terminal, which is in Kobe Section 5 of Hanshin Port, at night, SORA collided with the Kobe Airport East Approach Light Beacon when her master did not notice that she was navigating toward the light beacon because he was engaged in visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images.

It is probable that OM Kobe Co., Ltd.'s safety management was not functioning effectively because it did not clearly indicate and make known specific information concerning ordinary navigational watch stations that are required by stipulations in safety management regulations, and because sufficient safety education and training on the importance of keeping appropriate lookout using the radar and GPS plotter and sharing information among crew members had not been provided.

Although OM Kobe Co., Ltd. implemented various measures to prevent recurrence after the accident, given that, when navigation routes were investigated following the accident, it was found that vessels are navigating near the Kobe Airport East Approach Light Beacon, it is probable that safety education and training on the importance of navigating on the standard route whenever possible were not sufficiently provided.

(See Annex Figure: Navigation Tracks (Nighttime, October 9 to 18, 2018))

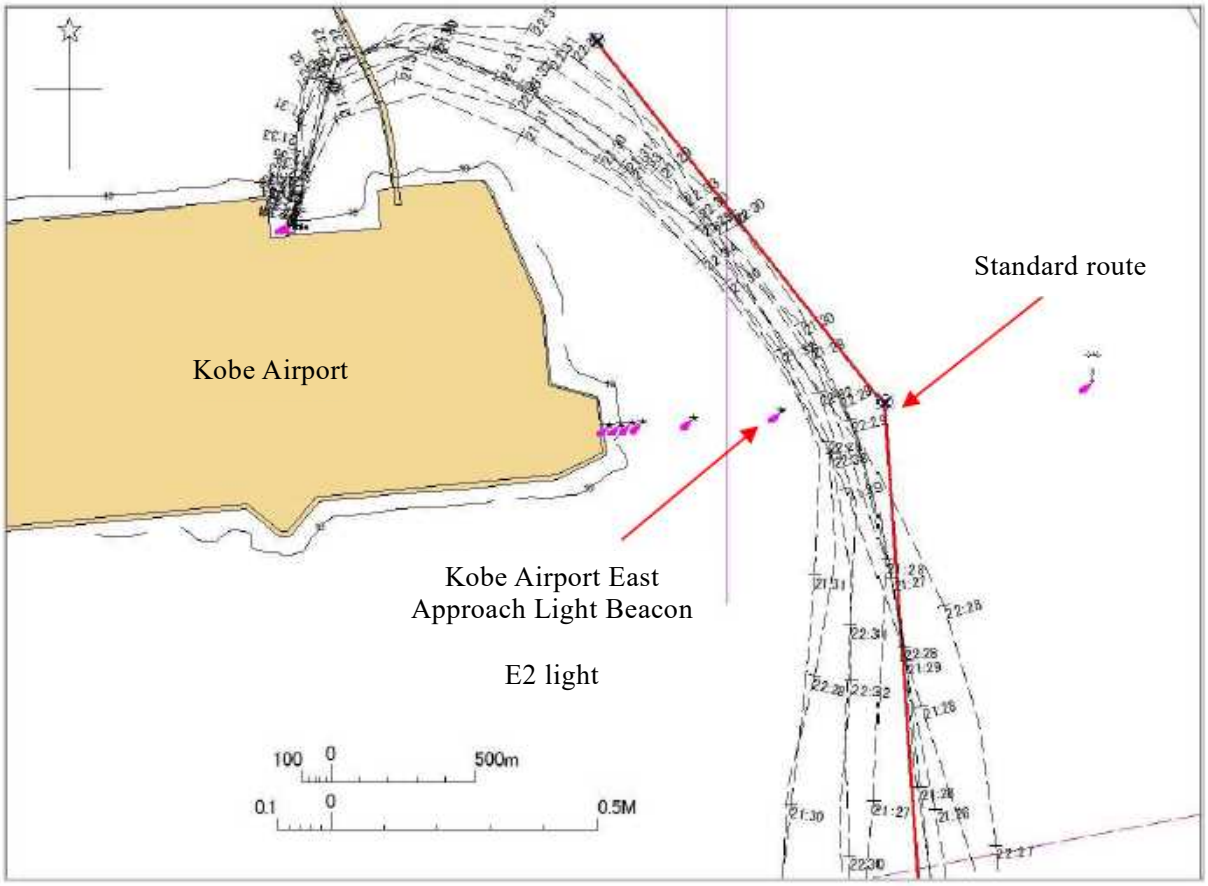
In view of the result of this accident investigation, the Japan Transport Safety Board recommends that OM Kobe Co., Ltd. implement the following measures pursuant to paragraph (1) of Article 27 of the Act for Establishment of the Japan Transport Safety Board in order to stably ensure the safety of passenger transport.

Additionally, the Japan Transport Safety Board requests that OM Kobe Co., Ltd. report measures taken based on these recommendations pursuant to paragraph (2) of the same Article.

Owing to the importance of having preventative measures continuously and reliably implemented, continuously provide education and training to crew members of operating contractors with emphasis on the following points:

(1) The importance of lookout that includes appropriate use of navigation equipment
(2) The importance of sharing information on navigational safety among crew members
(3) The importance of safe operation that includes use of equipment that aids for preventing grounding (collision)
(4) The importance of conducting appropriate ship maneuvering, including recognizing the safety of navigating on standard routes and navigating on standard routes whenever possible

Annex Figure: Navigation Tracks (Nighttime, October 9 to 18, 2018)



2 Opinions

(1) Aircraft Accident Involving a BELL 412EP (helicopter), Registered JA97NA, Operated by the Nagano Fire and Disaster Prevention Aviation Center

(Opinions on October 25, 2018)

Summary of the Accident

On Sunday, March 5, 2017, at 13:33 Japan Standard Time (JST: UTC + 9 hours; all times are indicated in JST on a 24-hour clock), a Bell 412EP, registered JA97NA, operated by the Nagano Fire and Disaster Prevention Aviation Center took off from Matsumoto Airport and was flying toward a temporary helipad in the mountains, Shiojiri City, Nagano Prefecture to conduct rescue training. At around 13:41, it collided with trees and then crashed onto the mountain's slope on Mt. Hachibuse, Matsumoto City, Nagano Prefecture.

There were nine persons on board the helicopter, consisting of a captain, eight others and all of them suffered fatal injuries.

The helicopter was destroyed, but there was no outbreak of fire.

Probable Cause

It is highly probable that in the accident occurred, while flying in a mountainous region, the helicopter collided with trees and crashed, because the helicopter did not take avoidance maneuver even getting closer to the ground.

Regarding the helicopter's not taking avoidance maneuver even getting closer to the ground while flying in a mountainous region, it is somewhat likely that the captain could not recognize the dangerous situation because the captain was in a state where the arousal level was lowered, however, it was not possible to clarify whether he actually fell into such a state.

Opinions to the Minister of Land, Infrastructure, Transport and Tourism

In the accident, it is highly probable that the captain had a past medical history and a surgical history and he was under treatment with medication. However, it is certain that he had obtained the aviation medical certificate without making a self-report on those medical information. In the examination for the Aviation Medical Certificate, it is difficult to make an appropriate judgment on whether to conform to the standards of Aviation Medical Examination unless applicants declare their medical history and information accurately.

Therefore, in view of the identified matters of the accident investigation, in order to ensure the safety of aviation, the Japan Transport Safety Board submit proposals pursuant to the provision of Article 28 of the Act for Establishment of the Japan Transport Safety Board to the Ministry of Land, Infrastructure, Transport and Tourism as follows:

When any measures were implemented according to these opinions, please notify the JTSB.

It is necessary that the Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism thoroughly instruct aircrews to accurately make a self-report on their medical information to apply for the aviation medical certification, and if non-conformity is suspected, they must not engage in the performance of aviation duties, and must receive instructions from the designated aviation medical examiners and others, even if his/her aviation medical certificate is still within validity period.

(2) Opinions on the Prevention of Train Derailments Caused by Gauge Widening

(Opinions on June 28, 2018)

Of the railway accidents investigated by the Japan Transport Safety Board, the following four train derailments caused by gauge widening occurred between October 2016 and May 2017.

October 6, 2016 Seino Railway Co., Ltd. Ichihashi Line
(Report No. RA2017-9-2 Published on December 21, 2017)
January 22, 2017 Kishu Railway Company Kishu Railway Line
(Report No. RA2018-1-2 Published on January 25, 2018)
February 22, 2017 Kumamoto Electric Railway Co., Ltd. Fujisaki Line
(Report No. RA2018-1-6 Published on January 25, 2018)
May 22, 2017 Watarase Keikoku Railway Co., Ltd. Watarase Keikoku Line
(Report No. RA2018-4-1 Published on June 28, 2018)

It is probable that the occurrence of these accidents was due to dynamic gauge widening caused by rail tilting and other factors with the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged points deserving attention from the standpoint of preventing similar accidents on regional railways that are based on knowledge obtained from these accident investigations into the attached "Prevention of Train Derailment Accidents Caused by Gauge Widening."

Accordingly, the JTSB expresses the following opinions to the Minister of Land, Infrastructure, Transport and Tourism pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

1. Make the content of the railway accident investigation reports of the four train derailment accidents and "Prevention of Train Derailment Accidents Caused by Gauge Widening" attached to these opinions thoroughly known to railway operators.

2. In light of the fact that it is recognized that derailment accidents are caused by defects in wooden sleepers and rail fastening devices, endeavor to provide necessary instruction to regional railways that includes use of existing public subsidy schemes and technical assistance schemes to promote measures to prevent gauge widening, such as replacing sleepers with concrete sleepers in a systematic manner that takes account of priority locations based on the occurrence of defects, alignment, and other factors.

Attachment

Prevention of Train Derailment Accidents Caused by Gauge Widening

Summary

Of the railway accidents investigated by the Japan Transport Safety Board, four train derailments caused by gauge widening occurred between October 2016 and May 2017. It is probable that the occurrence of these accidents was due to dynamic gauge widening caused by rail tilting and other factors attributable to the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged the following points deserving attention that are based on knowledge obtained from these accident investigations so as to contribute to the further improvement of safety from the standpoint of preventing similar accidents on regional railways.

1. Maintenance of tracks

It is necessary to appropriately manage sleepers, rail fastening devices, rail flow, etc., by conducting periodic track inspections and making track patrols, and, depending on the situation, to implement measures to prevent gauge widening, such as replacing or adding spikes, replacing sleepers, and installing gauge ties (fixtures that maintain gauge). Regarding this point, it is necessary to pay attention to the continuity of defects in sleepers and rail fastening devices, to put priority on sharp curves with large slack, and to pay attention to not only outer rails but also inner rails.

Regarding the measurement of track irregularity, dynamic track irregularity measurement using a track inspection car is effective. When managing track irregularity with static track irregularity measurement only, it is necessary to pay attention to the danger that dynamic track irregularity caused by rail tilting, etc., could occur and to sufficiently manage sleepers and rail fastening devices.

2. Standards for track maintenance

It is necessary to properly engage in track maintenance in response to the circumstances of track irregularity in order to prevent derailment accidents caused by gauge widening. Thus, with regard to maintenance standard values, it is desirable to establish standard values that take safety limits into account and to clarify maintenance periods. Furthermore, it is desirable to establish the rules of train operation control, track maintenance, and other matters when significant track irregularity is detected as necessary in addition to track maintenance standards for conventional track maintenance.

Regarding slack on curves, it is desirable to confirm that appropriate values are established for vehicles which run on the section and, when reexamining current values, to improve onsite slack simultaneously with track improvement work.

3. Track structure

It is desirable to replace wooden sleepers (including partial replacement that takes place at a rate of one sleeper for every two or three sleepers) with sleepers made of concrete or other materials that have better durability and can be maintained more easily in a systematic manner that takes priority locations into account based on the occurrence of wooden sleeper defects, alignment, and other factors.

Moreover, when laying guardrails on curves, it is desirable from the standpoint of preventing derailment accidents to lay derailment prevention guards or derailment prevention rails whenever possible at locations that are unaffected by falling rocks or snowfall. Additionally, when laying guardrails, it is necessary to also pay attention to the laying method in terms of number of fasteners on sleepers, height differences of rails and derailment prevention rails, etc.

Introduction

Of the railway accidents investigated by the Japan Transport Safety Board, the following four train derailments caused by gauge widening occurred between October 2016 and May 2017.

October 6, 2016 Seino Railway Co., Ltd. Ichihashi Line
(Report No. RA2017-9-2 Published on December 21, 2017)
January 22, 2017 Kishu Railway Company Kishu Railway Line
(Report No. RA2018-1-2 Published on January 25, 2018)
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(Report No. RA2018-1-6 Published on January 25, 2018)
May 22, 2017 Watarase Keikoku Railway Co., Ltd. Watarase Keikoku Line
(Report No. RA2018-4-1 Published on June 28, 2018)

It is probable that the occurrence of these accidents was due to dynamic gauge widening[*1] caused by rail tilting[*2] and other factors with the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged points deserving attention that are based on knowledge obtained from these accident investigations so as to contribute to the further improvement of safety from the standpoint of preventing similar accidents on regional railways.

It should be noted that, in the case of regional railways, it is important to undertake track maintenance and appropriately ascertain track conditions, and then to systematically execute facility repairs and replace wooden sleepers with precast concrete (PC) sleepers and other components beginning with priority locations, considering the degree of urgency according to the occurrence of defective locations. It is thought that the use of existing public subsidy schemes and technical assistance schemes is also effective toward this end.

1. Maintenance of tracks

(1) Management of sleepers and rail fastening devices

It is important to control dynamic gauge widening caused by rail tilting, etc., by appropriately managing sleepers and rail fastening devices to prevent derailment of wheels falling down between railsdue to gauge widening. (See Figure 1)

Appropriately managing dynamic gauge widening requires the periodic inspection of the condition of materials and maintenance of sleepers and rail fastening devices, record-keeping, and, depending on the situation, the implementation of measures to prevent gauge widening, such as replacing or adding spikes, replacing sleepers, and installing gauge ties (fixtures that maintain gauge).

Additionally, the condition of sleepers and rail fastening devices can be checked during

*1 "Gauge widening" refers to a situation in which a track's gauge has widened due to damage to rail fastening devices caused lateral pressure (the force generated by wheels pushing the rail laterally) or increasing rail wear. If the gauge widens beyond a certain degree, wheels on either the left or right side will become unsupportable by the rail's head and derailment will occur. Here, gauge widening caused by lateral pressure associated with running trains is called "dynamic gauge widening."

*2 "Rail tilting" refers to a phenomenon whereby a rail inclines from the load exerted by wheels on the rail.

track patrols. Track patrols can be conducted by train, on foot, or self-propelled railway inspection vehicle, or other means. However, in sections where the condition of sleepers is a concern, it is desirable to generally conduct inspections on foot, which allows better ascertainment of conditions.

Furthermore, it is necessary to pay attention to the number of spikes, method of driving spikes, etc., when using tie plates that affect rail tilting, etc. Figure 2 provides an example of standard tie plate spike driving for reference.*3

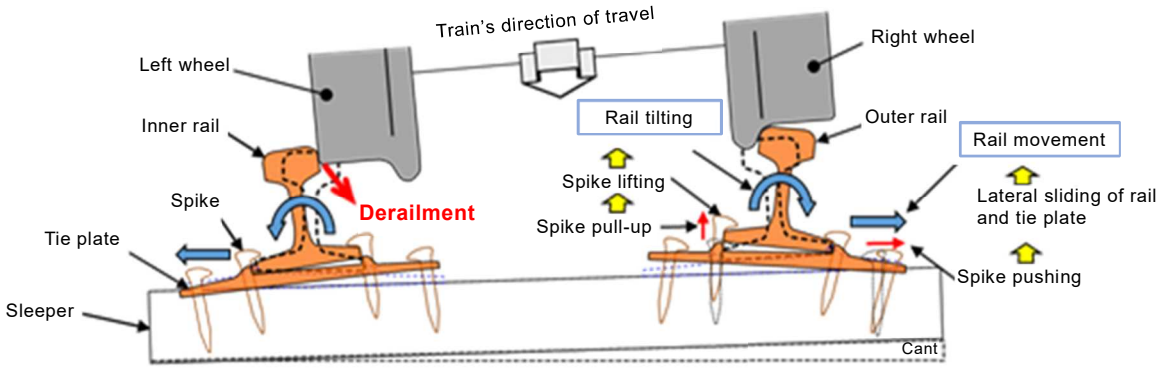
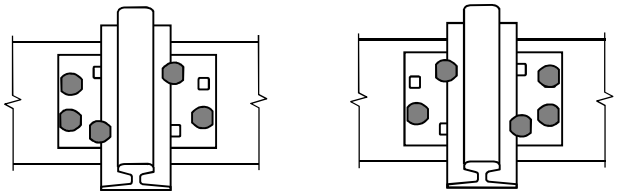


Figure 1: Example of a derailment caused by gauge widening



B-type/E-type tie plate For a curve with a radius of less than 500 m

Figure 2: Example of standard tie plate spike driving

Sleepers and rail fastening devices are track materials organized in a parallel system (rails and turnouts are a serial system), and are designed to allow the deterioration of individual components to a certain degree.*4 Accordingly, it is necessary to manage defects in sleepers and rail fastening devices with particular attention on continuity.

It is difficult to give a definitive guideline for the number of continuous defects because it depends on train speed and alignment; however, in general, up to two continuous defects is allowable.*5

Additionally, with regard to these points, it is necessary to give consideration so that maintenance is executed with priority on sharp curves with large slack, where the danger of derailment by gauge widening rises conspicuously. Moreover, in the management of sleepers and rail fastening devices on curves, there is a general tendency for more attention to be given to the outer rail, where significant lateral pressure tends to occur. However, lateral pressure that

*3 "Kido no Iji-Kanri Manyuaru" (track maintenance and management manual), Japan Railway Civil Engineering Association, March 2014, p. 115

*4 Tetsudo Kozobutsu-to Iji-Kanri Hyojun (Kido-hen) no Tebiki" (guide to maintenance and management standards for railway structures, etc. (tracks), Railway Technical Research Institute, March 2007, p. 154

*5 "Hosen no Joshiki-Hijoshiki" (common sense and irrationality in track maintenance), Hideyuki Takai, October 2009, p. 39

pushes the inner rail to the outside as a result of curve turning lateral force[*6] does occur. Thus, it is necessary to manage inner rails with the same attention as outer rails.

(2) Rail flow[*7]

When rail flow occurs on the rail gauge corner side, the rail head's metal surface is deformed and pushed inside the gauge. On the other hand, gauge is defined as the "shortest distance between the rail heads within 14 mm (or 16 mm) of the rail level." Because gauge is measured based on this, if rail flow is occurring, measurement will be from the tip of the rail flow and therefore the measured gauge will be smaller than the actual gauge by the amount of the rail flow (see Figure 3). Such a measurement suggests the danger of gauge widening, and there are cases where rail flow breaks and derailment by gauge widening occurs (see Figure 4).

Accordingly, when the occurrence of rail flow is confirmed through a periodic rail inspection, track patrol, etc., it is desirable to engage in appropriately management by removing the rail flow or taking other measures as necessary.

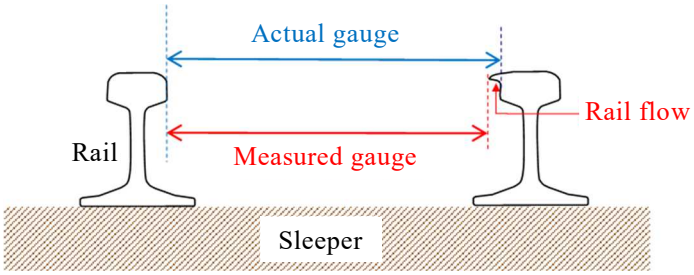


Figure 3: Gauge measurement when rail flow exists

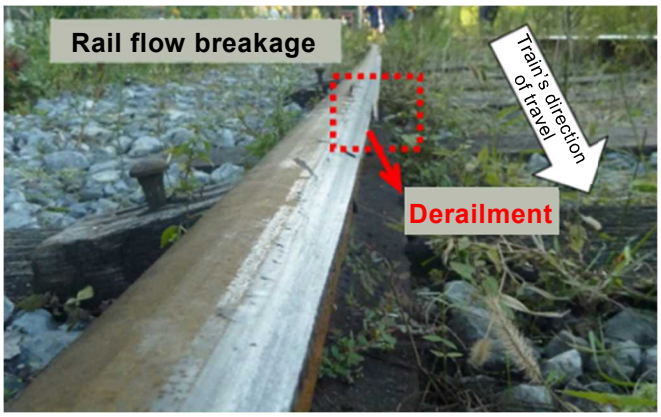


Figure 4: Example of rail flow breakage and derailment by gauge widening

[*6] "Curve turning lateral force" refers to lateral pressure that is generated when the front-axle inner rail wheel of a vehicle running on a curve resists with frictional force being pushed toward the inner rail by the outer rail wheel.

[*7] "Rail flow" refers to a phenomenon whereby a rail's surface metal flows plastically from the generation of significant contact pressure generated by the repeated passage of wheels over the rail head and the metal protrudes over the head's surface or edge.

(3) Measurement of track irregularityirregularity

It is thought that the occurrence of derailment due to gauge widening is often caused by the occurrence of dynamic gauge widening that arises from rail tilting caused by lateral pressure when trains pass, and that preventing accidents is possible through the discovery of abnormalities beforehand by measuring dynamic track irregularity[*8] and particularly the dynamic values of irregularity of gauge (hereinafter referred to as "dynamic irregularity of gauge").

Accordingly, when there are concerns of dynamic gauge widening based on the condition of sleepers and rail fastening devices, it is desirable to measure dynamic irregularity of gauge with a track inspection car or other means.

It should be noted that devices for easy measurement of dynamic track irregularity (irregularity of gauge and twist) for regional railways are currently being developed,[*9] and it is thought that they will become effective management tools when they are put into practical use.

When track irregularity is managed using static track irregularity measurement only because measuring dynamic track irregularity is difficult, it is necessary to pay attention to the danger that dynamic gauge widening caused by rail tilting, etc., could occur and to sufficiently manage sleepers and rail fastening devices in accordance with (1) above.

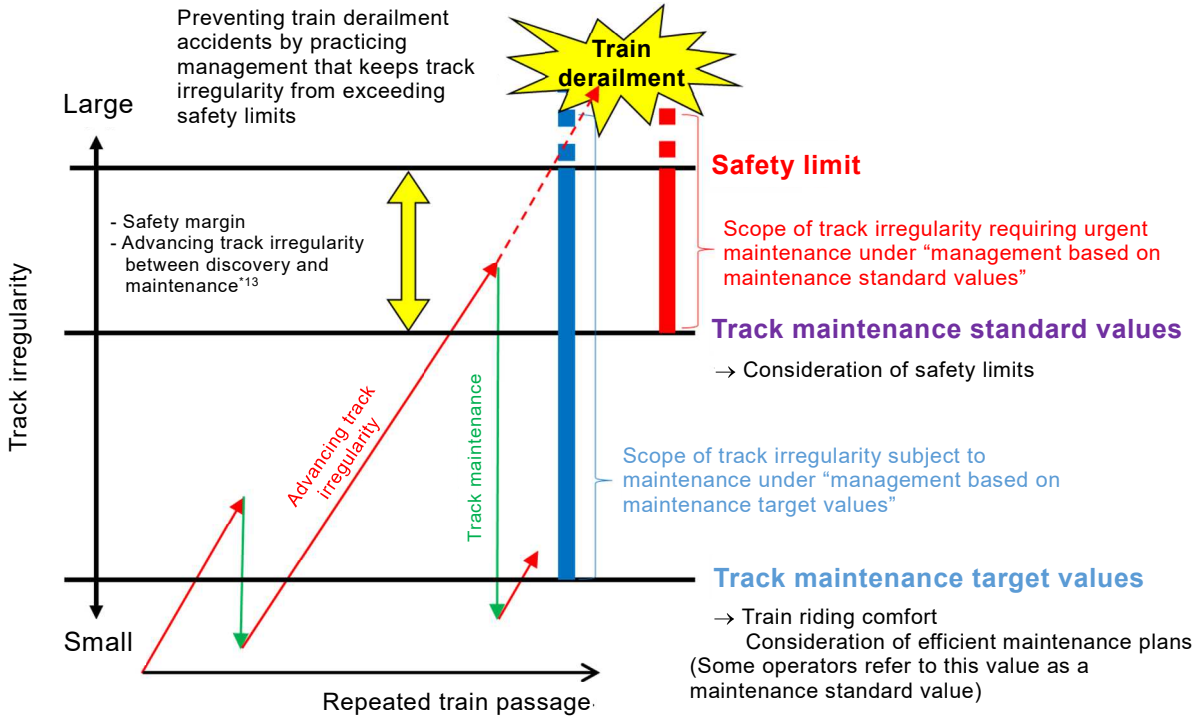
[*8] "Dynamic track irregularity" refers to track irregularity in a state in which train load is applied by a track inspection car, etc. On the other hand, track irregularity in a state in which train load (or a load equivalent to it) is not applied and measurements are made with string extended by human hands or a track inspection device is called "static track irregularity." Additionally, the measurement values of dynamic track irregularity are called "dynamic values" and those of static track irregularity are called "static values."

[*9] "Chiiki Tetsudo no Arikata ni kan-suru Kentokai Hokokusho" (report of the study group on the state of regional railways), Ministry of Land, Infrastructure, Transport and Tourism, March 2015, p. 26

2. Standards for track maintenance

(1) Maintenance standards for track irregularity*10

Maintenance standards for track irregularity include those established to ensure safe train operation and those established to ensure passenger comfort and efficient maintenance. In general, the former are called track maintenance standard values*11 and the latter are called track maintenance target values*12 (see Figure 5).



Note: Maintenance standards for track irregularity are established by each railway operator in accordance with each track section's facilities and vehicles running on the section.

Figure 5: Conceptual image of maintenance standards for track irregularity

Maintenance standards for track irregularity are set by each railway operator in accordance with the circumstances of track section's facilities and vehicles running on the section. However, in some cases operators only set values that are close to track maintenance target values.

It should be noted that some operators set time periods by which track maintenance must be conducted when a track maintenance standard value is exceeded (hereinafter referred to as "maintenance period"), but other operators do not clearly establish maintenance periods.

To prevent derailment accidents caused by gauge widening, it is important to manage track irregularity, particularly irregularity of gauge , and it is necessary to properly engage in track

*10 "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan"(explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor), December 2014, pp. 661-662

*11 "Track maintenance standard value" refers to a track irregularity value that was established to initiate urgent maintenance or repair work to ensure safe train operation.

*12 "Track maintenance target value" refers to a track irregularity value that was established to hold down the amount of urgent track maintenance work needed while maintaining a certain level of riding comfort.

*13 "Advancing track irregularity" refers to a phenomenon whereby track irregularity gradually becomes larger with the repeated passage of trains.

maintenance in response to the circumstances of track irregularity. Thus, it is desirable to aim for more precise management of track irregularity and, with regard to maintenance standards for track irregularity, to establish standard values that take safety limits into account and to clarify maintenance periods when those values are exceeded. (See Table 1 and Table 2)

Table 1: Track maintenance standard values Example of JR (conventional lines)

(Unit: mm)

Max. speed / Irregularity type	Maintenance standard value				
	Track section of 120 km/h or higher	Track section exceeding 95 km/h	Track section exceeding 85 km/h	Track section exceeding 45 km/h	Track section of 45 km/h or below
Gauge	・Straight track or curved track with radius exceeding 600 m 20 (14) ・Curved track with radius of between 200 m and 600 m 25 (19) ・Curved track with radius of less than 200 m 20 (14)				
Cross level	(Conduct maintenance based on the twist.)				
Longitudinal level	23 (15)	25 (17)	27 (19)	30 (22)	32 (24)
Alignment	23 (15)	25 (17)	27 (19)	30 (22)	32 (24)
Twist	23 (18) (Including cant digression)				

Remarks: (1) Figures indicate dynamic values from a high-speed track inspection car. However, figures within parentheses indicate static values.

(2) “Twist” indicates amount of level displacement per each 5 meters.

(3) Slack, cant, and versine (including vertical curve) are not included in curved tracks.

*14 “Kido no Iji-Kanri Manyuaru” (track maintenance and management manual), Japan Railway Civil Engineering Association, March 2014, p. 10

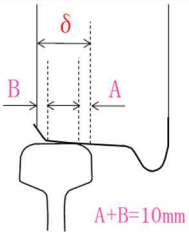
*15 “Tetsudo Kozobutsu-to Iji-Kanri Hyojun (Kido-hen) no Tebiki” (guide to maintenance and management standards for railway structures, etc. (tracks), Railway Technical Research Institute, March 2007, p. 31

Limit value gauge irregularity = δ − (10) − Margin (10) (mm)

Consideration of rail wear (A) + chamfering of wheel treadedge (B)

δ = wheel engagement with rail
= (wheel width + back gauge + flange thickness) – gauge (design value)

Gauge (design value) = gauge (basic measurements) + slack



Here, when wheel and axle measurements (minimum values), gauge (basic measurement) of 1,067 mm, and slack of 0 mm are applied, irregularity of gaugeirregularity limit value– (wheel width + back gauge + flange thickness) – gauge (design value) - 10 - 10

$$= (120+988+22) - 1,067 - 10 - 10 = 43 \fallingdotseq 40\,(\text{mm})$$

See "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan" (explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor)

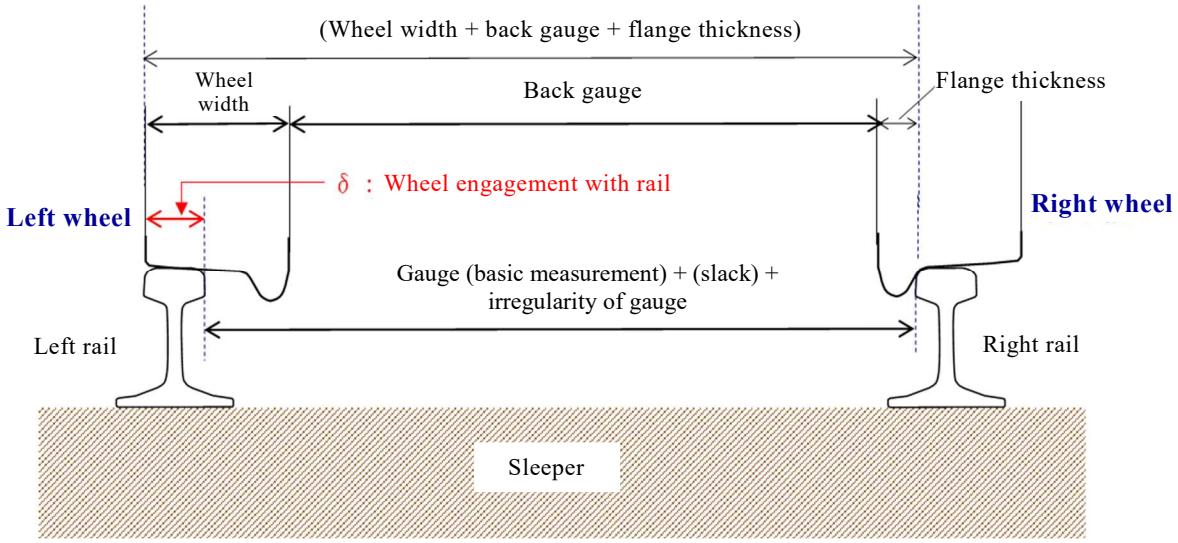


Figure 6: Limit values for iregularity of gauge

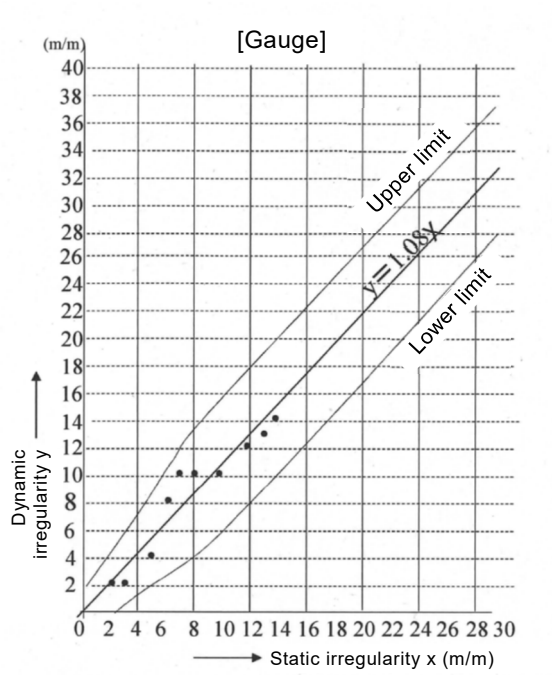


Figure 7: Relationship between dynamic irregularity of gauge and static irregularity of gauge

Table 2: Track maintenance target values　Example of JR (conventional lines)

(Unit: mm)

Irregularity type \ Max. speed		Maintenance target value			
		Track section of 120 km/h or higher	Track section exceeding 95 km/h	Track section exceeding 85 km/h	Track section of 85 km/h or below
Gauge	Location with radius of 800 m or higher	+10 (+6) -5 (-4)	+10 (+6) -5 (-4)		
	Location with radius of 200 m or higher		+15 (+9) -5 (-4)		
	Location with radius of less than 200 m		+10 (+6) -5 (-4)		
Cross level		11 (7)	12 (8)	13 (9)	16 (11)
Longitudinal level		13 (7)	14 (8)	16 (9)	19 (11)
Alighnment		13 (7)	14 (8)	16 (9)	19 (11)
Twist		-			

Remarks: (1) Figures indicate dynamic values from a high-speed track inspection car. However, figures within parentheses indicate static values.
(2) “Twist” indicates amount of level displacement per each 5 meters.
(3) Slack, cant, and versine (including vertical curve) are not included in curved tracks.
(4) Sidings are classified as 85 km/h or below.

Track maintenance standard values, which are established to ensure the safe operation of trains, are values set with consideration for margins for advancing track irregularity and other factors in the time period between the discovery of a circumstance exceeding the standard value and maintenance. Accordingly, it is desirable to establish a track irregularity value to serve as the evaluation standard (hereinafter referred to as “exceptionally large value”) and the handling of cases in which said value is exceeded beforehand, when necessary, so that operation control, such as suspension of operation, and track maintenance can be executed when an exceptionally large value that exceeds such an margin is observed at the time that track irregularity is discovered.

However, even when such exceptionally large values and their rules are established, it is important to execute track maintenance based on the track maintenance standard values and track maintenance target values.

Table 3: The rules of track irregularity and operation control
Example of the Watarase Keikoku Railway Co., Ltd.
(Established following a train derailment that occurred on May 22, 2017)

Irregularity type	Track irregularity (dynamic value)	Track irregularity (static value)	Operation control
Gauge (including slack)	+42 mm or more -12 mm or less	+38 mm or more -12 mm or less	Suspension of operation
Twist (including cant digression)	27 mm or more	21 mm or more	
Longitudinal level	39 mm or more	34 mm or more	
Alignment	35 mm or more	33 mm or more	
Longitudinal level	36 mm or more less than 39 mm	29 mm or more less than 34 mm	Slowing down, no more than 25 km/h
Alignment	34 mm or more less than 35 mm	28 mm or more less than 33 mm	

*When the track irregularity described above is confirmed, immediately make arrangements with concerned locations and execute repairs (e.g., track maintenance, etc.). Terminate operation control after confirming that the situation falls below track maintenance standard values.

(3) Setting of slack[*16]

It is desirable from the standpoint of preventing derailments caused by gauge widening for curve slack to be as small as possible in order to raise the margin.

The upper and lower limits for slack in sections that are not sections in which two-axle vehicles mainly run (i.e., are sections in which three-axle vehicles run) are as follows.

[*16] "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan"(explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor), December 2014, pp. 115-121

Table 4: Slack amounts

(Unit: mm)

Curve radius	3-axle car	2-axle car
Less than 200 m	20	5
At least 200 m but less than 240 m	15	-
At least 240 m but less than 320 m	10	-
At least 320 m but less than 440 m	5	-

The conditions of cars that run in each section must be considered when deciding optimum values within the range in which slack is gained. However, in many sections, the values for three-axle cars shown in Table 4 are generally thought to be appropriate if consideration is given to achieving a good balance between the smooth running of various vehicles and the margin vis-à-vis derailment by gauge widening.

Additionally, because changing slack amounts involves comparatively large-scale construction, it is desirable to make sequential improvements by, for example, executing construction together with improvement work on targeted curves.

3. Track structure

(1) Sleeper materials

It is desirable to replace wooden sleepers with sleepers made of concrete or other materials (PC sleepers, for example), that have better durability and can be maintained more easily. The replacement with concrete sleepers must be done in a systematic manner that takes priority locations into account based on the occurrence of wooden sleeper defects, alignment, and other factors.

Figure 8: Example of partial replacement with PC sleepers

However, partial replacement at a rate of one sleeper for every two or three sleepers is effective when replacing the total number of sleepers is problematic due to the cost or other factors (see Figure 8). When doing so, it is desirable to determine the ratio of sleepers to be replaced with sleepers made of concrete, etc., with consideration for vehicles running on the section, alignment, and other conditions.

(2) Guard rails on curves*17

1) Types

Guard rails on curves are laid on "curves having an estimated derailment quotient of under 1.2" that are targeted for measures to prevent accidents like that which occurred on the Eidan (now Tokyo Metro) Hibiya Line on March 8, 2000, as well as at other locations where the risk of derailment exists and locations where great damage and injury would occur if a derailment happened. Their types are "guard angles,"*18 "guard rails,"*19 and "guardrails."*20

Guard angles and Guard rails are laid for the purpose of preventing derailments in themselves, while guardrails are laid to prevent to the greatest degree possible deviation following a derailment. It is desirable from the standpoint of preventing derailment accidents to lay guard angles or guard rails whenever possible.

The general thinking regarding the laying of guardrails is "guardrails are to be laid in locations where guard angles or guard rails are necessary but troublesome to install." "Troublesome" locations are determined with consideration for falling rocks and snowfall as well as the ease of maintenance (economic efficiency) of the track.

2) Laying methods

Guard angles, guard rails, and guardrails must be appropriately laid so that their effects are demonstrated.

For laying locations, lay on the inside of the gauge of the rail on the opposite side of a location thought to be hazardous, such as a location where it is assumed that an adjacent line could be blocked in a derailment or serious damage could occur if a car overturned, and lay on both sides when necessary.

*17 "Shashin de Miru Senro Kanri no Teibiki"(photographic guide to track management), Japan Railway Civil Engineering Association, September 2016, pp. 232-234

*18 A "guard angle" is an L-shaped steel guarding device installed inside the gauge and parallel to the main rail to prevent serious accidents caused by derailment.

*19 A "guard rails" is a rail installed inside the gauge and parallel to the main rail to prevent serious accidents caused by derailment.

*20 A "guardrail" is a guiding rail laid alongside to the main rail to prevent serious accidents caused by tipping over or falling when a derailed wheel deviates outside the gauge.

However, it is thought that when a guard angle or a guard rail is lower than the main rail, the guard angle's or guard rail's engagement with inner rim face of a wheel that comes into contact with it is small, making it easier for the wheel to ride over it, and therefore it is possible that the guard angle's or guard rail's derailment-prevention functions cannot be fully demonstrated. It is therefore desirable to make the guard angle or guard rail the same height or higher than the main rail. Additionally, it is desirable to fasten guard rails to each sleeper with spikes.

Lay guardrails inside the gauge of the rail on the opposite side of the more hazardous side. However, in places where rocks fall or with heavy snowfall, lay guardrails on the outside of the gauge of the rail on the more hazardous side. It is permissible to fasten guardrails with spikes to every other sleeper.

3) Management with periodic inspections and track patrols

It is necessary to inspect and check the materials and maintenance of guard rails through periodic inspections and track patrols and to make repairs as conditions require.

It should be noted that, in the case of guard rails laid on curves (attention is particularly required for guard angles and guard rails), the guard rail's face and the face of the wheel's inner rim come into contact in a derailment, etc. Consequently, if there are abrasion marks on a guard rail's face, it is necessary to consider the possibility of derailment (derailment by gauge widening or flange climb derailment) and to make necessary inspections and repairs. It is possible to prevent derailment accidents by taking these steps.

Measures Taken Based on These Opinions

Based on knowledge obtained from accident investigations of the four train derailment accidents caused by gauge widening that occurred between October 2016 and May 2017, the Japan Transport Safety Board expressed opinions to the Minister of Land, Infrastructure, Transport and Tourism on June 28, 2018, from the standpoint of preventing similar accidents on regional railways and received the following notification concerning measures that were implemented based on the opinions on August 21, 2018.

Measures Taken by the Ministry of Land, Infrastructure, Transport and Tourism based on the Opinions

Regarding the subject matter of the opinions provided in UN-I-SAN No. 43 dated June 28, 2018, this is to provide notification, with associated materials, that the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) issued "Regarding Response to the Opinions of the Japan Transport Safety Board" (KOKU-TETSU-GI No. 55, KOKU-TETSU-SHI No. 82, KOKU-TETSU-AN No. 27), "Regarding the Promotion of Gauge Widening Prevention Measures on Regional Railways" (KOKU-TETSU-SHI No. 84), and "Regarding Railway Accident Investigation Reports, etc., of the Japan Transport Safety Board (Published in June)" (administrative communication) on June 28 of this year.

Accordingly, MLIT made the content of the Japan Transport Safety Board's opinions and the attachmet "Prevention of Train Derailment Accidents Caused by Gauge Widening" and the railway accident report concerning Watarase Keikoku Railway Co., Ltd. fully known to railway operators under its jurisdiction through district transport bureaus. Additionally, with regard to item 2 of the Opinions, MLIT instructed railway operators under its jurisdiction to check the management of their sleepers and other facilities and to take necessary measures based on the results.

Furthermore, MLIT adds that, of the four accident investigation reports involving train derailment that were attached to the Opinions, it had completed notifying railway operators under its jurisdiction through district transport bureaus with an administrative communication dated December 21, 2017, in the case of Seino Railway Co., Ltd. and an administrative communication dated January 25, 2018, in the case of Kishu Railway Company and Kumamoto Electric Railway Co., Ltd., and that it will continue instructing regional railway operators to firmly establish activities toward preventing train derailments caused by gauge widening through district transport bureaus.

*The content of the notification and its associated materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/railkankoku/railway-iken4re-1_20180828.pdf

(3) Opinions on the Railway Serious Incident (Dangerous Trouble in Vehicle) for Trains Operated by the West Japan Railway Company that occurred on the Tokaido Shinkansen line

(Opinions on June 28, 2018)

Summary of the Serious Incident

On Monday, December 11, 2017, the inbound 34A train (Nozomi No. 34), composed of 16 vehicles of West Japan Railway Company started from Hakata Station bound for Tokyo Station, departed from Hakata Station of Sanyo Shinkansen on schedule (around 13:33). Immediately after leaving Hakata Station, crew members and others noticed an odor inside the train and abnormal noises coming from under a vehicle's floor. However, the train continued operating to Shin-Osaka Station and its operation was subsequently assumed by Central Japan Railway Company.

At around 16:53, when the train arrived at Nagoya Station of Tokaido Shinkansen, car maintenance personnel who had been dispatched to Nagoya Station under instructions contained in operational orders from Central Japan Railway Company confirmed that abnormal noises were coming from the fourth vehicle, and they conducted an underfloor inspection at Nagoya Station at around 17:03.

As a result of the inspection, an oil leak was found in a bogie of the fourth vehicle (near the gear case) and therefore the operation of the train was suspended.

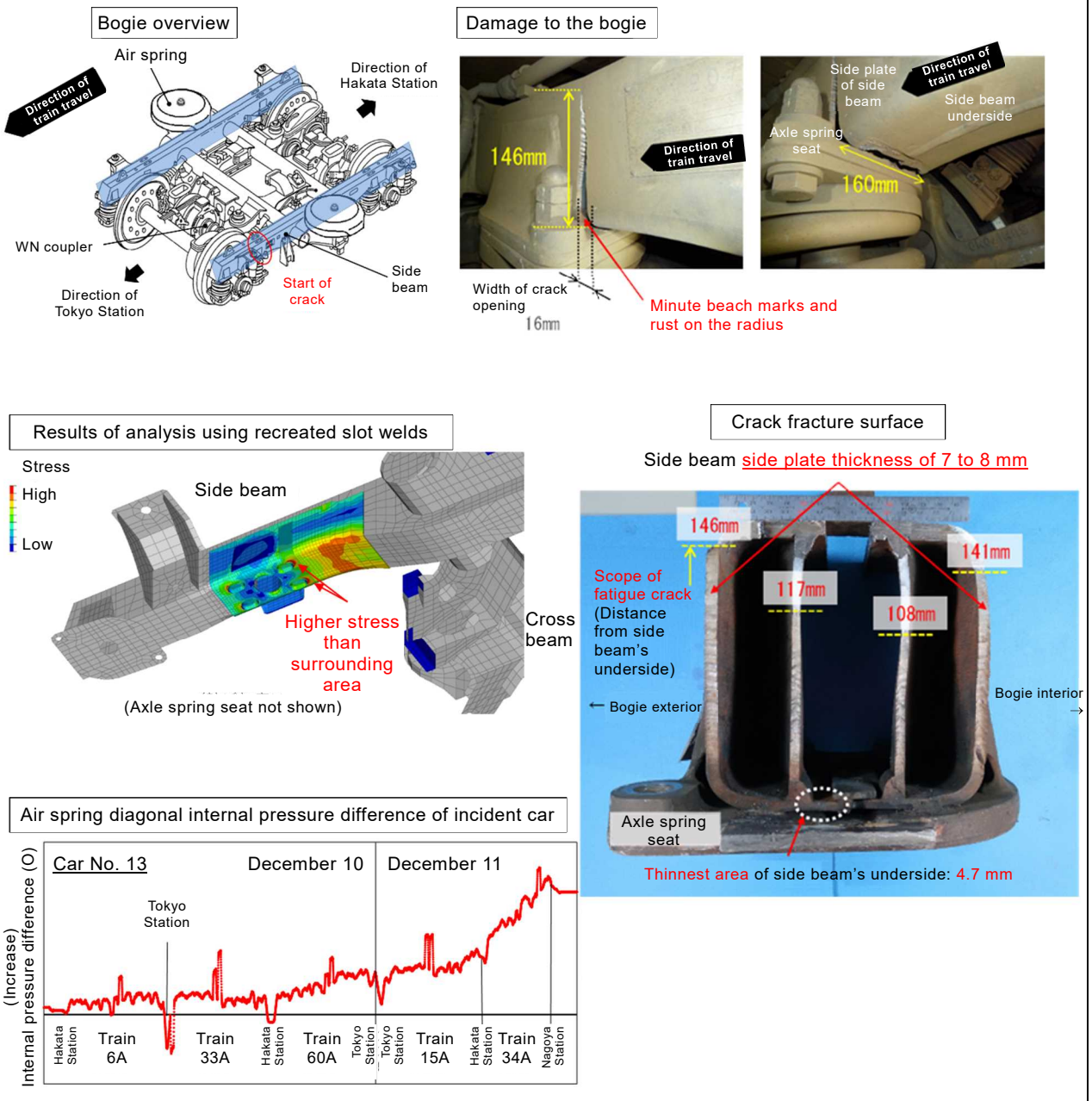
Subsequently, when work was underway to move the vehicle to a depot (Nagoya Rolling Stock Depot), a crack was discovered in the left side beam of the bogie frame of the front bogie of the fourth vehicle at around 23:40.

When the train arrived at Nagoya Station, there were approximately 1,000 passengers and seven crew members (one driver, three conductors, and three pursers) aboard; however, no one was injured.

The vehicles operating as the 34A train belong to West Japan Railway Company.

Factual Information and Analysis Contained in the Interim Report (Summary)

- It is highly probable the starting point of the crack is near two slot welds that attach the axle spring seat to the underside of the side beam.
- It is thought possible that grinding of the side beam's undersurface at the time of the bogie frame's manufacture (ordinarily plate thickness is at least 7 mm, but the thinnest part of the affected area was 4.7 mm) and overlay welding on the axle spring seat's undersurface contributed to breakage of the slot welds, the occurrence of a fatigue crack, and the crack's growth. It is thought that grinding of the side beam's underside influenced the speed at which the crack grew.
- When an analysis was conducted using a model of the actual structure near the crack (a structure made by overlaying and joining the side beam and axle spring seat), a situation in which stress was higher near the crack's starting point than the surrounding area was observed.
- From air spring internal pressure records, it is thought that the crack had progressed to a degree that it affected the side beam's rigidity on the previous day, and that the crack had spread to the point that it affected other bogie components on the day of the incident.



Opinions to the Minister of Land, Infrastructure, Transport and Tourism

It is thought that work at the time of the bogie frame's manufacture may have contributed significantly to the crack in the bogie in this serious incident. The JTSB arranged the following matters that should be addressed in order to prevent recurrence in the bogie frame manufacturing process as well as at each stage—including design/inspection and use—based on results obtained from studies and analyses on bogie frames conducted heretofore.

The Minister of Land, Infrastructure, Transport and Tourism should take necessary measures to address these matters.

1. Matters concerning manufacturing

(1) Thoroughly execute manufacturing management in the manufacture of bogie frames to ensure that manufacturing processes do not cause losses of component strength so that design strength

is maintained.

(2) Develop a system that can reliably execute the following as a framework whereby only sound products are put into actual use.

1) Whenever a problem involving trouble or difficult in production arises at a bogie frame manufacturing site and it becomes necessary to explore solutions that involve component processing, etc., evaluate as a systematic response how the problem and its solution will affect the safety of bogie frames.

2) If a problem arising in production or its solution will affect the safety of bogie frames, cease operations, investigate the cause by going back to the manufacturing process or design, study measures to address the cause, and confirm that the results of the measures are favorable before resuming operations.

2. Matters concerning design and verification

(1) In computer-based strength analysis (FEM analysis) during strength design of a bogie frame that will use a new structure, bear in mind that it is important to reproduce to the degree possible the structural characteristics of locally joining plates of different rigidities as well as the constraining conditions of positions that will support load in order to get a picture of stresses that is closer to reality, and also to consider ascertaining the tendencies of areas that are subject to high stress based on the special qualities of calculation error in FEM analysis from the results of that analysis.

(2) Even in the case of an existing bogie frame, consider reconfirming the calculation models used during strength design to determine whether or not the structural qualities of locally joining plates of different rigidities and the constraining conditions of positions that support load are reproduced as much as possible, improving the calculation models, and then again ascertaining the tendencies of individual areas that are subject to high stress.

3. Matters concerning inspection

(1) In flaw tests using magnetic particle inspection or penetrant inspection that are conducted in periodic bogie inspections, consider ascertaining the tendencies of individual areas that are subject to high stress and then adding specified areas for flaw tests based on safety rates for welded joints, etc.

(2) Bogie frames have places where high stress tendencies are observed in areas that cannot be seen from outside, even if a crack has advanced and passed through a component, because of the presence of other components (i.e., areas that cannot be inspected with magnetic particle inspection or penetrant inspection). Thus, consider conducting ultrasonic inspections or other tests of pertinent areas with appropriate frequency.

4. Matters concerning detection of abnormalities

Consider mechanisms that effectively utilize data for air spring internal pressure, etc., to notify crew members of abnormalities so as to permit the early and precise detection of cracks

and other abnormalities in bogies.

Measures Taken Based on These Opinions

The Japan Transport Safety Board issued a progress report on June 28, 2018, concerning the serious incident involving cracking and other problems in a bogie frame that occurred on the Tokaido-Sanyo Shinkansen "Nozomi 34" (cars operated by West Japan Railway Company) on December 11, 2017. The JTSB also delivered opinions concerning this serious incident to the Minister of Land, Infrastructure, Transport and Tourism and received the following notification concerning measures that were implemented based on the opinions on August 21, 2018.

Measures Taken by the Ministry of Land, Infrastructure, Transport and Tourism based on the Opinions

Regarding the subject matter of the opinions provided in UN-I-SAN No. 46 dated June 28, 2018, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) issued "Regarding Response to 'Regarding Response to the Progress Report of the Investigation of the Serious Railway Incident'" (KOKU-TETSU-GI No. 56, KOKU-TETSU-GI No. 56-2, KOKU-TETSU-GI No. 56-3, KOKU-TETSU-AN No. 28) and notified railway operators under its jurisdiction and concerned bodies of the content of the Japan Transport Safety Board's progress report and opinions through district transport bureaus on June 28 of this year.

Furthermore, following a study of this serious incident by the "Study Group on Measures Concerning Railway Transport Troubles" and MLIT's recent receipt of the study group's report on those measures, MLIT issued "Regarding the Report of the Study Group on Measures Concerning Railway Transport Troubles" (Kokutetsuso No. 129, KOKU-TETSU-GI No. 79, KOKU-TETSU-GI No. 79-2, KOKU-TETSU-GI No. 79-3, KOKU-TETSU-AN No. 29, KOKU-TETSU-SHI No. 118) on July 30 of this year and instructed railway operators under its jurisdiction and concerned bodies to make efforts to study and implement measures to reduce railway troubles based on the intent of the report through district transport bureaus.

MLIT hereby provides notification of the above with associated materials.

MILT added that it will continue instructing railway operators to firmly establish activities toward preventing bogie cracking through district transport bureaus.

*The content of the notification and its associated materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/railkankoku/railway-iken3re-1_20180828.pdf

(4) Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea

(Accident resulting in the death of a fishing passenger of the fishing ferry KASUGA MARU)

(Opinions on February 22, 2018)

Opinions to the Director-General of the Fisheries Agency

1. Fishing ferry accidents

It is probable that this accident resulting in the death of a fishing passenger of the fishing ferry KASUGA MARU (hereinafter referred to as "the Accident") occurred when, as the fishing ferry KASUGA MARU was gathering fishing passengers at Minohana, near the northwestern shore of Futaoijima Island, on December 29, 2016, she received a wave with a height exceeding approximately 3 meters, a result of which was that the hull moved and a fishing passenger lost his balance and slid down into a low depression from the point where he had begun to board and into the sea. In subsequent rescue activities, the skipper threw a life buoy into the water and pulled the fishing passenger toward the vessel's side, but he could not pull the fishing passenger up onto the vessel and the fishing passenger died by drowning.

On the other hand, in an accident in which a fishing passenger of the fishing ferry HAIYA MARU fell into the sea and died that occurred on the day after the Accident, it is somewhat likely that a life buoy was not used in rescue because the skipper did not think of using a life buoy and the storage location of life buoys was not made known to fishing passengers, and that this situation contributed to the fishing passenger's drowning.

In investigation reports issued by the Japan Transport Safety Board between October 2008 and December 2017, which included that for the HAIYA MARU accident, there were 330 accidents and incidents involving recreational fishing vessels, 54 accidents and incidents involving fishing ferries, and one collision between a recreational fishing vessel and a fishing ferry, making a total of 385 accidents and incidents, that were in addition to the Accident. Of these accidents and incidents, there were 26 accidents that involved 38 fishing passengers falling into the sea, and of those who fell overboard, 13 died (11 of whom died by drowning).

2. Necessary matters for the rescue of fishing passengers who fall into the sea

Although the circumstances of the Accident and HAIYA MARU accident differ, both involved a fishing passenger's falling into the sea when boarding at a landing spot and, although the fishing passenger was subsequently observed to be alive, rescue could not be made and the fishing passenger died by drowning. Moreover, in addition to the Accident, 13 fishing passengers died (11 of whom died by downing) in 26 accidents in which a fishing passenger aboard a recreational fishing vessel or fishing ferry, including the HAIYA MARU accident, fell into the sea.

In order to prevent the occurrence of cases in which people falling into the sea and raise the probability of survival in the event that a person falls into the sea, it is considered necessary for skippers and operations managers to implement the following.

(1) Skippers and operations managers avoid situations in which landing or boarding on rocks is

difficult through early grasping of the conditions of fishing passengers and rocks by obtaining the latest weather and sea information, fully complying with operational regulations, and patrolling rocks.

(2) Because floating by obtaining buoyancy is important for rescue when a person falls into the sea, users of fishing ferries wear and appropriately use lifejackets and other devices that are products that have received type approval for the usage environment or have performance exceeding such products. Additionally, in situations of high and rough waves, rescue the fallen person quickly due to the danger that the person will accidentally inhale seawater.

(3) Inform fishing passengers to quickly and surely grasp thrown life buoys if they fall into the sea and, on recreational fishing vessels and fishing ferries that have few crew members, inform fishing passengers of where life buoys are stored and how to use them in preparation for cases in which fishing passengers will conduct rescue activities as well as cases in which a fishing passenger who falls in the sea must be rescued.

(4) On recreational fishing vessels and fishing ferries with few crew members, have ladders and other devices ready on the vessel to make it easier to lift a person who has fallen into the sea onto the vessel.

(5) Conduct periodic training for scenarios in which a person has fallen into the sea, as training can lead to awareness of necessary actions and consciousness and to resolution of areas requiring improvement in onboard equipment, and it can help crew members master appropriate actions through repetition and raise the level of safety.

It is thought that the actions described in (1), (3) and (4) were not executed in the case of the Accident and the actions of (3) and (4) were not executed in the case of the HAIYA MARU, and as a result the two fishing passengers who fell into the sea died by drowning. Moreover, in addition to the Accident, 13 fishing passengers died in 26 accidents in which a fishing passenger aboard a recreational fishing vessel or fishing ferry, including the HAIYA MARU accident, fell into the sea.

3. Measures pertaining to necessary matters for the rescue of fishing passengers who fall into the sea

It is probable that a system for preventing the occurrence of cases in which people falling into the sea and raising the probability of survival in the event that a person falls into the sea will be built with the unfailing execution of all actions described in 2 (1) to (4), and that the appropriate operation of such a system will be possible with the action described in 2 (5).

When recreational fishing vessels and fishing ferries engage in operations, their operators are required to operate after establishing operational regulations based on Model Operational Regulations established by the Fisheries Agency. Because Article 15 paragraph 2 of the Model Operational Regulations stipulates that skippers must implement thorough measures to ensure the safety of human lives, measures to prevent the spread of accidents, and measures to dispel users' concerns when a marine accident occurs or is likely to occur, it is thought that prefectural governors must provide instruction to recreational fishing vessel and fishing ferry operators concerning the execution of the actions described in 2.

In accordance with the above, the JTSB expresses the following opinions to the Director-

General of the Fisheries Agency, who oversees the Act on Regulation of Sportfishing Boat Service, pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

The Director-General of the Fisheries Agency should advise prefectural governors so that operators of recreational fishing vessels and fishing ferries execute the following measures, and should also study means of having the measures executed with certainty, such as using the opportunities provided by training of operations managers on recreational fishing vessels.

(1) Skippers and operations managers of fishing ferries fully comply with operational regulations and periodically patrol rocks on which fishing passengers have landed.
(2) Skippers and operations managers of fishing ferries urge users to wear and appropriately use lifejackets and other devices that are products that have received type approval for the usage environment or have performance exceeding such products, and, in situations of high and rough waves, conduct rescue quickly due to the danger that a person in the sea will accidentally inhale seawater.
(3) Skippers and operations managers of recreational fishing vessels and fishing ferries inform users of where life buoys are stored and how to use them.
(4) Operators of recreational fishing vessels and fishing ferries have ladders and other devices ready on the vessel that can provide help when lifting a person who has fallen into the sea onto the vessel.
(5) Operators of recreational fishing vessels and fishing ferries conduct periodic training for scenarios in which a person has fallen into the sea.

Measures Taken Based on These Opinions

The Japan Transport Safety Board delivered opinions to the Director-General of the Fisheries Agency on February 22, 2018, and received the following notifications concerning measures that were implemented based on the opinions on March 27, 2018, and October 23, 2018.

Measures Taken by the Fisheries Agency Based on These Opinions

Notification 1 (March 6, 2018)

This is to provide notification that the Fisheries Agency has received “Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea” through UN-I-SAN No. 286, dated February 22, 2018, and has notified prefectural governors and organizations that train operations managers of recreational fishing vessels as separately attached in order to ensure the safety of recreational fishing vessel users.

Summary of the attachment

- Advice to prefectural governors to provide guidance to recreational fishing vessel operators, etc., under their jurisdiction
- Request to organizations that train operations managers of recreational fishing vessels to make the content of the Opinions known during training and to work to ensure an even high level of safety.

・Revision of the Model Operational Regulations, which are regulations concerning the conduct of recreational fishing vessel business

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken13re-1_20180327.pdf

Notification 2 (October 22, 2018)

The Fisheries Agency previously notified the JTSB that it received "Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea" (UN-I-SAN No. 286, dated February 22, 2018), issued on February 22, 2018, and that it notified prefectural governors and organizations that train operations managers of recreational fishing vessels of "Regarding Opinions Received from the Japan Transport Safety Board" (Suikan No. 291, dated March 5, 2018) in order to ensure the safety of recreational fishing vessel users. This is to notify the JTSB that the Fisheries Agency has revised the Model Operational Regulations as shown in the separately attached.

Summary of the attachment

・Partial revision of Model Regulations Concerning the Conduct of Recreational Fishing Vessel Business (Operational Regulations) (October 22, 2018)
Red: Additional provision Blue: Existing provision

Measures to be taken by recreational fishing vessel operators, etc.	Corresponding provision, etc., of the Model Operational Regulations
(1) Periodic patrols of rocks	Annexed Table 9 (Matters to be observed to ensure safety) Periodically patrol shores on which users have been landed to confirm their safety.
(2) Promotion of wearing/use of lifejackets suitable for use environment	Annexed Table 8 (Matters to be made known to ensure safety) Except when inside a cabin, wear a lifejacket or other device (a device that meets requirements established by the Ministry of Land, Infrastructure, Transport and Tourism for the type of vessel and area of navigation that is provided on the vessel or brought aboard) while on board.
(3) Life buoy storage locations, etc.	Annexed Table 8 Storage locations and use of lifejackets and life buoys
(4) Onboard furnishment of ladders, etc.	Article 7 (Omitted) 2 Operators shall equip recreational fishing vessels with ladders and other devices that can provide help when lifting a user who has fallen into the sea onto the vessel. Annexed Table 8 Storage locations and use of ladders, etc., to assist when lifting a person in the sea onto a vessel
(5) Implementation of periodic training	Article 9 (Omitted) 3 Operators shall conduct periodic training for scenarios in which a person has fallen into the sea so that the operator and employees can rescue a person in the sea with precision.

・Advice to prefectural governors
Make the revisions to the Model Operational Regulations known to recreational fishing vessel operators under their jurisdiction and direct those operators to quickly modify their operational regulations.

・Request to organizations that train operations managers
Provide instruction on accident-prevention measures that are based on the revised Model Operational Revisions in training.

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken13re-2_20181023.pdf

(5) Regarding Opinions Concerning the Prevention of Collision Accidents Involving Recreational Fishing Vessels

(Opinions on July 24, 2018)

Opinions to the Director-General of the Fisheries Agency

1. Collisions by recreational fishing vessels

Among the investigation reports on accidents and incidents that the Japan Transport Safety Board issued between October 2008 and March 2018, 176 concerned collisions by recreational fishing vessels. A total of 352 vessels were involved in those accidents, of which 190 were recreational fishing vessels.

Of those accidents, 93 resulted in death or injury to 195 people, and of those killed or injured, 82 were fishing passengers (1 dead, 2 with serious injuries, and 79 with minor injuries) and 16 were crew members on recreational fishing vessels, and 97 (2 dead, 15 with serious injuries, and 80 with minor injuries) were on other vessels.

2. Major factors leading to collision

The following are identified as major factors based on analysis of the reports.

(1) A total of 144 of the accidents involved a collision by a recreational fishing vessel that was underway (approximately 82% of the total). Of them, 109 involved a collision between a recreational fishing vessel that was underway and a vessel that was drifting or at anchor (approximately 76% of accidents involving a vessel underway).

The main factors leading to collisions by recreational fishing vessels that were underway were as follows.

(a) Not conducting lookout that compensated for a blind spot

(b) Navigating while operating a fish finder or navigation equipment

(c) Maneuvering while looking at another vessel or another direction

(d) Not maintaining continuous lookout of the other vessel

(2) A total of 45 accidents involved a collision with a recreational fishing vessel that was drifting or at anchor (hereinafter referred to as “recreational fishing vessels that were drifting, etc.”) (approximately 26% of the total).

The main factors leading to collisions by recreational fishing vessels that were at drifting, etc., were as follows.

(a) Not maintaining continuous monitoring or delay in raising attention or taking avoiding action due to belief that the other vessel would avoid own vessel or had a reason for approaching own vessel

(b) Preoccupation with handling fishing passengers

Additionally, the vessels that were underway were largely unaware of the presence of the recreational fishing vessels that were drifting, etc., and this situation was attributable to their

not conducting lookout that compensated for a blind spot, engaging in other operations, finding fishing grounds with a fish finder, etc.

3. Matters required of skippers of recreational fishing vessels

When recreational fishing vessels engage in operations, their operators are required to operate after establishing operational regulations based on Model Operational Regulations established by the Fisheries Agency (obligation on operators to provide notification pursuant to Article 11 of the Act on Regulation of Sportfishing Boat Service). Article 14 of the Model Operational Regulations stipulates that skippers must engage in safe navigation by complying with safety laws and ordinances at sea while also paying sufficient attention to maintaining the safety of users during navigation, and, while allowing users to harvest aquatic animals and plants, must constantly strive to ascertain the movements of other vessels by keeping appropriate lookout and engage in appropriate maneuvering to avoid collisions with other vessels. Skippers of recreational fishing vessels are therefore required to execute said actions.

In accordance with the above, the JTSB expresses the following opinions to the Director-General of the Fisheries Agency, who oversees the Act on Regulation of Sportfishing Boat Service, pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

The Director-General of the Fisheries Agency should advise prefectural governors so that operators of recreational fishing vessels execute the following measures, and should also study means of having the measures executed with certainty, such as using the opportunities provided by training of operations managers on recreational fishing vessels.

(1) Skippers of recreational fishing vessels constantly keep appropriate lookout during navigation, such as when going to and from fishing places and moving within fishing places.

(2) Skippers of recreational fishing vessels maintain lookout even when drifting or at anchor and take avoiding action when necessary.

(3) In addition to (1) and (2), skippers of recreational fishing vessels understand the characteristics of the collision accidents described in JTSB Digests Issue No. 29 “For Prevention of Collisions of Recreational Fishing Vessels,” comply with operational regulations, and make efforts to ensure users’ safety.

Measures Taken Based on These Opinions

The Japan Transport Safety Board delivered opinions to the Director-General of the Fisheries Agency on July 24, 2018, and received the following notification concerning measures that were implemented based on the opinions on August 9, 2018.

Measures Taken by the Fisheries Agency Based on These Opinions

This is to provide notification that the Fisheries Agency has received “Regarding Opinions Concerning the Prevention of Collision Accidents Involving Recreational Fishing Vessels” through UN-I-SAN No. 64 dated July 24, 2018, and has notified heads of prefectural departments in charge

of fisheries and organizations that train operations managers of recreational fishing vessels as separately attached in order to prevent collision accidents involving recreational fishing vessels and to ensure the safety of recreational fishing vessel users.

Summary of the attachment

- Advice to prefectures to instruct recreational fishing vessel operators under their jurisdiction to rigidly enforce lookout, comply with operational regulations, and ensure users' safety.
- Request to organizations that train operations managers of recreational fishing vessels to make the content of Japan Transport Safety Board's Opinions known during training.

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken14re_20180828.pdf

3 Safety Recommendations

(1) Fire on the Cargo Ship TAI YUAN

(Safety Recommendations on October 25, 2018)

Summary of the Accident

At around 13:20 on April 24, 2017, as the cargo ship TAI YUAN, with a master and ten other crew members aboard, was waiting to begin loading of waste metal and other miscellaneous scrap at the No. 16 Berth of Hakozaki Wharf, Hakata Port, Fukuoka City, Fukuoka Prefecture, a fire broke out in the aft cargo hold.

At around 04:54 on the following day, April 25, TAI YUAN foundered during firefighting and became a total loss. An oil spill occurred, but there were no fatalities or injuries.

Probable Causes

It is probable that the accident occurred when, as the Vessel was moored for the purpose of cargo-handling at Hakata Port, a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using the Vessel's carbon dioxide gas firefighting equipment were not employed.

It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment.

It is probable that the Master did not think of using the carbon dioxide gas firefighting equipment because he did not have experience with fire drills for a fire in the Vessel's cargo holds and because the Vessel and Miki Shouji Co., Ltd. did not share information on effective firefighting methods for times of fire.

It is somewhat likely that firefighting by water-spraying was not effective because the sprayed water was blocked by the scrap's surface layer and did not reach the fire's origin.

Regarding the fire that broke out inside the scrap, it is somewhat likely that a spark created by contact between metal objects, a battery, etc., was the source of the fire, and that the source ignited combustible material. However, it was not possible to determine the circumstances leading up to the fire.

Safety Recommendations to the TAI YUAN (HONG KONG) INTERNATIONAL SHIPPING CO., LTD.

It is probable that the accident occurred when a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using TAI YUAN's carbon dioxide gas firefighting equipment were not employed.

It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment

were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment because the Master did not have experience with fire drills for a fire in TAI YUAN's cargo holds and because TAI YUAN and Miki Shouji Co., Ltd. did not share information on effective firefighting methods for times of fire.

Additionally, it is probable that, as a result of the accident, oil that spilled from the foundered TAI YUAN spread through a large area of Hakata Bay and caused harm to the fishing industry.

In view of the result of this accident investigation, the Japan Transport Safety Board recommends that Tai Yuan (Hong Kong) International Shipping Co., Ltd., which is the owner of TAI YUAN, take the following measures for the purpose of preventing the occurrence of a similar accident and reducing damage:

Tai Yuan (Hong Kong) International Shipping Co., Ltd. shall provide thorough instruction to masters of its vessels to unfailingly execute the following measures and shall also implement training in accordance with said measures:

(1) Build a thorough system for appropriate and smooth firefighting in case of fire with the loading business by considering and determining effective firefighting methods in accordance with the cargo's characteristics beforehand and conveying this information to the loading business.

(2) Pay full attention to the following points regarding firefighting methods for fires within piled scrap:

1) Firefighting by water-spraying may not be effective because the sprayed water can be blocked by the scrap's surface layer and not reach the fire's origin.

2) Insulation material and other combustible items with low specific gravity may float in a burning state even when the water level in the cargo holds rises from continuous water-spraying and continue to burn on the water's surface.

3) Firefighting using carbon dioxide gas firefighting equipment is effective.

4) When a vessel has multiple cargo holds, measures such as immediately closing and sealing the hatch covers of cargo holds other than the cargo hold with the fire shall be taken to prevent the spread of fire.

(3) Reliably provide information on firefighting equipment aboard the vessel to the firefighting organization.

(4) Implement measures as soon as possible to control oil, such as closing air vents and setting up oil fences, whenever the danger of an oil spill from a vessel arises.

Chapter 2 Summary of major investigation activities in 2018

In the case of occurrence of aircraft, railway, or marine accidents, the JTSB designates an investigator-in-charge and accident investigators who begin investigations to determine their causes. Since we can never know when or where accidents may occur, the personnel of the Board, including accident investigators, are making continuous efforts to be able to conduct investigation activities immediately when accidents should occur.

Accident investigators conduct investigations and invite comments from parties relevant to the cause of the accident; accordingly, they make draft recommendations or opinions regarding the measures to be taken to prevent the recurrence of accidents and to mitigate damage caused by accidents. Therefore, they shall endeavor to improve their level of skill and knowledge by participating in national and international training; moreover, they share accident information among international society by attending international conferences.

In the future, we will continue to carry out thorough investigations into the causes of aircraft, railway, and marine accidents, and will publish our investigation reports as soon as possible. Based on the results of our investigations, who will also make recommendations and state our opinions as necessary to related government institutions and parties relevant to the causes of accidents to prevent the recurrence of accidents.

1 Major accidents and serious incidents occurred in 2018 for which investigations commenced

The accidents listed below were the primary subject for investigation of the various accidents occurred in 2018.

(1) Aviation mode

- **Crash of an AS350B3 Eurocopter (rotorcraft) belonging to Excel Air Service Inc. near the sealine some 40 km northwest of Naha Airport <Occurred on June 7>**
- **Cabin attendant injury by shaking of aircraft Injuries sustained by cabin crew as a result of turbulence on board a Boeing 777-300 (large aeroplane) belonging to Japan Airlines some 80 km north of Sendai Airport at an altitude of approximately 9,000 meters < Occurred on June 24>**
- **Crash of a Bell 412EP helicopter (rotorcraft) belonging to the Gunma Disaster Relief Aviation Corps in the mountains of Nakanojo-machi, Agatsuma-gun, Gunma Prefecure < Occurred on August 10>**
- **Serious incident involving damage to the engine of a Boeing 767-300 (large aeroplane) belonging to Japan Airlines some 10km west of Kumamoto Airport at an altitude of approximately 1,800 meters < Occurred on May 24>**
- **Serious incident involving damage to the right landing gear of a Boeing 777-300 (large aeroplane) belonging to Korean Air on the runway at Narita International Airport < Occurred on June 29>**

Damage to the right landing gear of a Korean Air plane

14 aircraft accidents were subject to investigation, with investigations into the causes of 35 accidents performed, including 21 ongoing accident investigations from the previous year. Further, 12 aircraft serious incidents were subject to investigation, with investigations into the causes of 34 serious incidents performed, including 22 ongoing serious incident investigations from the previous year.

(2) Railway mode

- **Train derailment of a Japan Freight Railway Company train inside Tomamu Station on the Sekisho Line (Shimukappu Village, Hokkaido) <Occurred on February 24>**
- **Train derailment of a Keiyorinkai train inside Soga Station on the Rinkai Line (Chiba City, Chiba Prefecture) < Occurred on June 16>**
- **Level crossing accident (class 4) on the Iwasakinoichi level crossing (Fukuyama City, Hiroshima Prefecture) between Michinoue Station and Managura Station on the Fukuen Line operated by West Japan Railway Company <Occurred on September 27>**
- **Dangerous trouble in vehicle serious incident between Kasugabaru Station and Zasshonokuma Station (Fukuoka City, Fukuoka Prefecture) on the Tenjin Omuta Line operated by the Nishi-Nippon Railroad Co., Ltd. < Occurred on May 15>**
- **Dangerous damage in facirities serious incidentat Shin-sapporo Station on the Chitose Line (Sapporo City, Hokkaido) operated by the Hokkaido Railway Company < Occurred on November 9>**

Overturned signal light (inside Shinsapporo Station)

11 railway accidents were subject to investigation, with investigations into the causes of 26 accidents performed, including 15 ongoing accident investigations from the previous year. Further, two railway serious incidents were subject to investigation, with investigations into the causes of three serious incidents performed, including one ongoing serious incident investigation from the previous year.

(3) Marine mode

- **Collision between the container ships NYK VENUS and SITC OSAKA (offshore Rokko Island, Kobe City, Hyogo Prefecture) <Occurred on May 4>**
- **Contact (with a quay) involving the Ferry SAKURAJIMA MARU No.18(Sakurajima Ferry landing quay, Sakurajima Yokoyamacho, Kagoshima City, Kagoshima Prefecture) <Occurred on July 28>**
- **Contact (with a bridge) involving the oil tanker HOUNMARU (Kansai International Airport Connecting Bridge inSenshu Port, Osaka Prefecure) <Occurred on September 4>**
- **Contact (with a bridge) involving the cargo ship ERNA OLDENDORFF (near the middle of Oshima Long Bridge in Yamaguchi Prefecure) <Occurred on October 22>**
- **Serious incident involving the suspension of service of the ferry KONPIRA 2 (loss of power) (Takamatsu Port, Takamatsu City, Kagawa Prefecture) <Occurred on July 12>**

Oil tanker HOUNMARU after contact with a bridge

828 marine accidents were subject to investigation, with investigations into the causes of 1,353

accidents performed, including 531 ongoing accident investigations from the previous year (excluding six incidents deemed to not be an accident as a result of investigations). Further, 130 marine incidents were subject to investigation, with investigations into the causes of 221 incidents performed, including 91 ongoing incident investigations from the previous year.

2 Major accidents and serious incidents for which investigation reports were published in 2018

Completed investigation into the causes of accidents, etc. undergo committee (subcommittee) review/resolution, investigation reports are submitted to the Minister of Land, Infrastructure and Transport, and published on the Japan Transport Safety Board website. Major accidents, etc. published on the Japan Transport Safety Board website are as follows.

Engine fire on a Korean Air plane

(1) Aviation mode

- **Engine fire during take off roll involving a Boeing 777-300 (large aeroplane) belonging to Korean Air at Tokyo International Airport <Occurred on May 27, 2016>**
- **Crash of a Bell 412EP helicopter (rotorcraft) belonging to the Nagano Fire and Disaster Prevention Aviation Center on Mt. Hachibuse, Matsumoto City, Nagano Prefecure <Occurred on March 5, 2017>**
- **Crash of a Cessna 172P airplane (small aeroplane) belonging to New Central Airservice Co., Ltd, into the vicinity of the top of Mt. Shishi-dake in the Tateyama mountain range <Occurred on June 3, 2017>**
- **Serious incident involving a Bombardier DHC-8-402 airplane (large aeroplane) belonging to ANA WINGS Co., Ltd, overrunning the runway at the New Chitose Airport <Occurred on January 19, 2017>**
- **Serious incident of collision between parts dropped from Boeing 777-200 (large aeroplane) belonging to KLM Royal Dutch Airlines and facilities in Osaka City, Osaka Prefecture <Occurred on September 23, 2017>**

(For more details, see pages 38~42 of “Feature 2 Summaries of major aircraft accident and serious incident investigation reports (case studies)”

Completed investigation reports into 18 aircraft accidents and 19 serious aircraft incidents have been published.

Of the investigation reports published, the Japan Transport Safety Board gave its recommendations on August 30 to the Minister of Land, Infrastructure and Transport concerning the “Crash of Cessna 172P airplane (small aeroplane) belonging to New Central Airservice Co., Ltd, into the vicinit of the top of Mt. Shishi-dake in the Tateyama mountain range”.

The Japan Transport Safety Board also presented its opinion on the “Crash of a Bell 412EP helicopter (rotorcraft) belonging to the Nagano Fire and Disaster Prevention Aviation Center on Mt. Hachibuse, Matsumoto City, Nagano Prefecure” to the Minister of Land, Infrastructure and Transport on October 25.

(For more details, see page 60 of “Chapter 1 Summary of recommendations and opinions issued in 2018”)

(2) Railway mode

- **Train derailment of Tojo Main Line of Tobu Railway Company in the premises of Naka-itabashi station, (Itabashi-ku, Tokyo) <Occurred on May 18, 2016>**
- **Train derailment of Watarase Keikoku Line of Watarase Keikoku Railway Co., Ltd., between Hanawa Station and Mizunuma Station on the Watarase Keikoku Line (Kiryu City, Gunma Prefecture) <Occurred on May 22, 2017>**
- **Train derailment of a Japan Freight Railway Company train inside the Kitairie Signal Station on the Muroran Line (Toyako own, Abuta-gun, Hokkaido) <Occurred on February 23, 2017>**
- **Railway traffic accident involving property damage by a Kyushu Railway Company train inside Noogata Station on the Chikuhou Line (Noogata City, Fukuoka Prefecture) <Occurred on September 18, 2017>**
- **Level crossing accident concerning a Central Japan Railway Company train between Kasado Station and Idagawa Station on the Kansai Line (Suzuka City, Mie Prefecture) <Occurred on January 16, 2018>**

First axle of the front carriage of the second car　Left wheel

Watarase Keikoku Railway Train derailment

(For more details, see pages 43~47 of "Feature 2 Summaries of major railway accident and serious incident investigation reports (case studies)"

Completed investigation reports into 15 railway accidents have been published.

Of the investigation reports published, the Japan Transport Safety Board presented its opinion to the Minister of Land, Infrastructure and Transport on June 28, with due consideration given to the opinions gleaned from accidents investigations into the four train derailments occurring as a result of an increasing track gage seen in the period from October 2016 to May 2017, including the "train derailment of a Watarase Keikoku Railway train on the Watarase Keikoku Line", with the view to preventing similar accidents on regional railways.

(For more details, see pages 62~76 of "Chapter 1 Summary of recommendations and opinions issued in 2018")

(3) Marine mode

- **Fire accident on board the passenger ferry SUN FLOWER DAISETSU (South shore off Tomakomai Port, Hokkaido) <Occurred on July 31, 2015>**
- **Collision between the container ship ESTELLE MAERSK and the container ship JJ SKY (Kobe Central Sea-lane, Kobe-ku, Hanshin Port) <Occurred on June 7, 2016>**
- **Fire on board the cargo ship TAI YUAN (Quay 16, Hakozakifuto, Hakata Port, Fukuoka City, Fukuoka Prefecture) <Occurred on April 24, 2017>**
- **Contact with an approach light beacon involving the passenger ship SORA (Kobe Dairoku-ku, Hanshin Port) <Occurred on July 26, 2017>**

Fire on board the cargo ship TAI YUAN

(For more details, see pages 48~52 of "Feature 2 Summaries of major marine accident investigation reports (case studies)"

Completed investigation reports into 757 marine accidents and 131 incidents have been published.

Of the investigation reports published, the Japan Transport Safety Board gave recommendations on December 20 concerning the "Contact with an approach light beacon involving the passenger ship SORA " to OM Kobe (the vessel owner).

Further, the Japan Transport Safety Board gave safety recommendations concerning the "Fire on board the cargo ship TAI YUAN" to TAI YUAN (HONG KONG) INTERNATIONAL SHIPPING CO., LTD. (the vessel owner).

Additionally, the opinion of the Japan Transport Safety Board was presented to the Director General of the Fisheries Agency on February 22 concerning the fatal accident involving a visiting angler on board the fishing vessel KASUGAMARU.

A further 176 collision accidents involving recreational fishing vessels were analyzed, based on which the Japan Transport Safety Board advised prefectural governors to implement measures ensuring the safe operation of such vessels, such as appropriate lookout measures to be conducted by captains of such recreational fishing vessels for accident prevention, and presented its opinion to the Director General of the Fisheries Agency on July 24 concerning requests for a review into the means of ensuring that such service operators implement said safety measures.

(For more details, see pages 85~87 of "Chapter 1 Summary of recommendations and opinions issued in 2018")

3 Accidents and serious incidents for which progress reports were published in 2018

Accident progress reports are made to the Minister of Land, Infrastructure and Transport, and published on the Japan Transport Safety Board website where deemed necessary during accident investigations, etc. to prevent a recurrence of such accidents. Progress reports of accidents, etc. published on the Japan Transport Safety Board website are as follows.

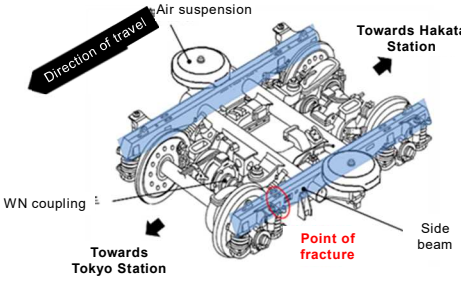
(1) Railway mode

- **Serious incident involving "Nozomi No. 34" on the Tokaido Shinkansen (car belonging to the West Japan Railway Company) <Occurred on December 11, 2017>**

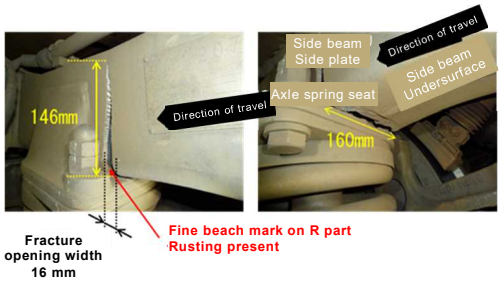
With regard to this serious railway incident under investigation, a progress report was made to the Minister of Land, Infrastructure and Transport on June 28 and published online concerning the details on the course of investigation following the uncovering of new information deemed useful for preventing the recurrence of similar circumstances concerning cracks found in train carriages.

Further, in light of matters presented in this progress report, the opinion of the Japan Transport Safety Board was presented to the Minister of Land, Infrastructure and Transport on June 28 concerning recommended measures for preventing such accidents, etc.

(For more details, see pages 77~80 of "Chapter 1 Summary of recommendations and opinions issued in 2018")



Train carriage overview



State of damage to the train carriage

*This progress report has been published on the Japan Transport Safety Board website.
http://www.mlit.go.jp/jtsb/railway/rep-inci/keika180628.pdf

(2) Marine mode

- **Collision involving the oil tanker HOUNMARU (with a bridge) <Occurred on September 4, 2018>**

This marine accident under investigation is expected to require further time to compile the final report due to the need to conduct further fact-finding and analysis, and to hear the opinions of parties relevant to the cause to this accident.

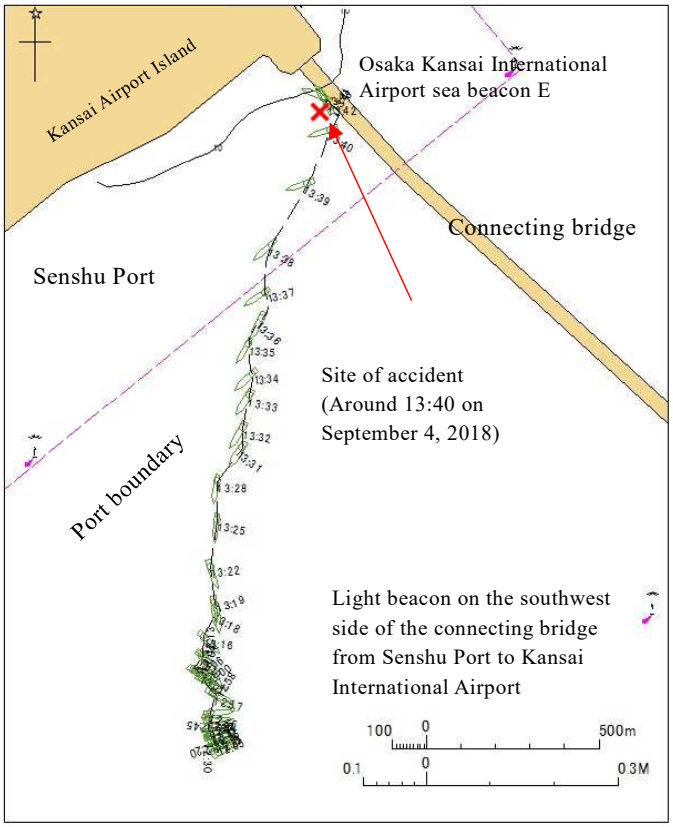
However, from the perspective of preventing similar accidents, a progress report was presented to the Minister of Land, Infrastructure and Transport on December 20 and published online, providing a general overview of the accident, a timeline of the accident investigation and facts verified at the current time.

○ **Summary of the accident included in the progress report**

The oil tanker HOUNMARU (hereafter, "the vessel"), with the captain and 10 other crew members on board, collided with the bridge connecting the Kansai International Airport (hereafter, the "connecting bridge") at around 13:40 on September 4, 2018 after strong winds dragged the vessel while anchored offshore southeast of Senshu Port. A typhoon warning had been issued for the Inland Sea of Japan, including Osaka Bay, at the time of the accident following the approach of Typhoon Jebi.

The collision crushed the deck and living quarters on the starboard bow of the vessel, and the connecting bridge incurred damage including the bending, fracturing and grazing, etc. of the bridge structure, the toppling of railway girder wire poles, malformation of the rail track, etc. and damage to the gas piping. There were no casualties among the crew members on board.

Appended map 1 Navigation course (general view)



*This progress report has been published on the Japan Transport Safety Board website.
http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/keika20181220-0_2018tk0013.pdf

Chapter 3 Aircraft accident and serious incident investigations

1 Aircraft accidents and serious incidents to be investigated

<Aircraft accidents to be investigated>

◎Paragraph 1, Article 2 of the Act for Establishment of the Japan Transport Safety Board (Definition of aircraft accident)

The term "Aircraft Accident" as used in this Act shall mean the accident listed in each of the items in paragraph 1 of Article 76 of the Civil Aeronautics Act.

◎Paragraph 1, Article 76 of the Civil Aeronautics Act (Obligation to report)

1 Crash, collision or fire of aircraft;
2 Injury or death of any person, or destruction of any object caused by aircraft;
3 Death (except those specified in Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism) or disappearance of any person on board the aircraft;
4 Contact with other aircraft; and
5 Other accidents relating to aircraft specified in Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism.

◎Article 165-3 of the Ordinance for Enforcement of the Civil Aeronautics Act

(Accidents related to aircraft prescribed in the Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism under item 5 of the paragraph1 of the Article 76 of the Act)

The cases (excluding cases where the repair of a subject aircraft does not correspond to the major repair work) where navigating aircraft is damaged (except the sole damage of engine, cowling, engine accessory, propeller, wing tip, antenna, tire, brake or fairing).

<Aircraft serious incidents to be investigated>

◎Item 2, Paragraph 2, Article 2 of the Act for Establishment of the Japan Transport Safety Board (Definition of aircraft serious incident)

A situation where a pilot in command of an aircraft during flight recognized a risk of collision or contact with any other aircraft, or any other situations prescribed by the Ordinances of Ministry of Land, Infrastructure, Transport and Tourism under Article 76-2 of the Civil Aeronautics Act.

◎Article 76-2 of the Civil Aeronautics Act

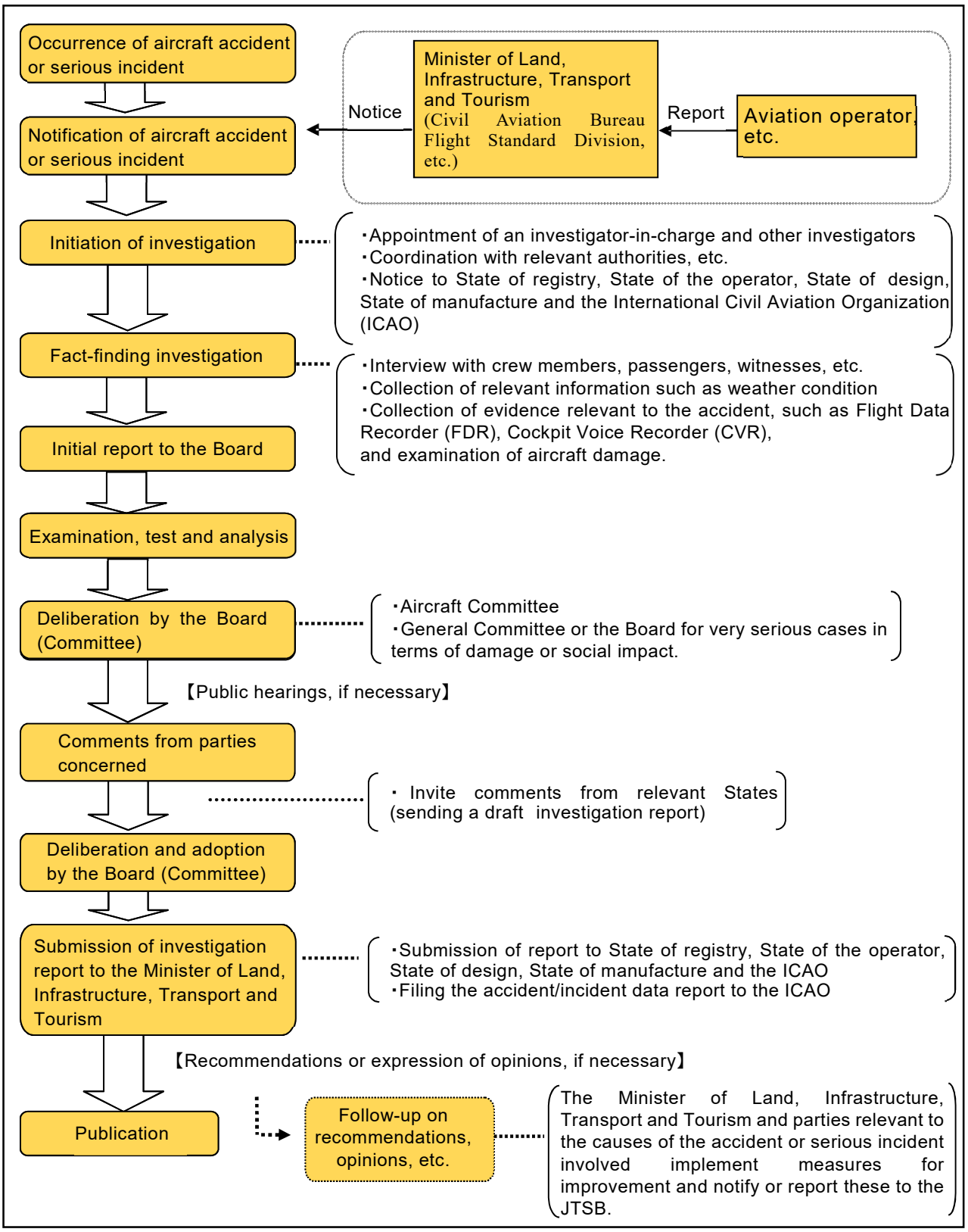
・When the pilot in command has recognized during flight that there was a danger of collision or contact with any other aircraft.

・When the pilot in command has recognized during flight that there is a danger of causing any of accidents listed in each item of paragraph 1, article 76 of the Civil Aeronautics Act, specified by Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism.

◎**Article 166-4 of the Ordinance for Enforcement of the Civil Aeronautics Act** (The case prescribed in the Ordinances of the Ministry of Land, Infrastructure, Transport and Tourism under Article 76-2 of the Civil Aeronautics Act)

1 Take-off from a closed runway or a runway being used by other aircraft or aborted take-off
2 Landing on a closed runway or a runway being used by other aircraft or attempt of landing
3 Overrun, undershoot and deviation from a runway (limited to when an aircraft is disabled to perform taxiing)
4 Case where emergency evacuation was conducted with the use for emergency evacuation slide
5 Case where aircraft crew executed an emergency operation during navigation in order to avoid crash into water or contact on the ground
6 Damage of engine (limited to such a case where fragments penetrated the casing of subject engine
7 Continued halt or loss of power or thrust (except when the engine(s) are stopped with an attempt of assuming the engine(s) of a motor glider) of engines (in the case of multiple engines, 2 or more engines) in flight
8 Case where any of aircraft propeller, rotary wing, landing gear, rudder, elevator, aileron or flap is damaged and thus flight of the subject aircraft could be continued
9 Multiple malfunctions in one or more systems equipped on aircraft impeding the safe flight of aircraft
10 Occurrence of fire or smoke inside an aircraft and occurrence of fire within an engine fire-prevention area
11 Abnormal decompression inside an aircraft
12 Shortage of fuel requiring urgent measures
13 Case where aircraft operation is impeded by an encounter with air disturbance or other abnormal weather conditions, failure in aircraft equipment, or a flight at a speed exceeding the airspeed limit, limited payload factor limit operating altitude limit
14 Case where aircraft crew became unable to perform services normally due to injury or disease
15 Case where a slung load, any other load carried external to an aircraft or an object being towed by an aircraft was released unintentionally or intentionally as an emergency measure
16 Case where parts dropped from aircraft collided with one or more persons
17 Case equivalent to those listed in the preceding items

2 Procedure of aircraft accident/incident investigation



3 Statistics of investigations of aircraft accidents and serious incidents

The JTSB carried out investigations of aircraft accidents and serious incidents in 2018 as follows:

21 accident investigations had been carried over from 2017, and 14 accident investigations were newly launched in 2018. 18 investigation reports were published in 2018, and thereby 15 accident investigations were carried over to 2019.

22 serious incident investigations had been carried over from 2017, and 12 serious incident investigations were newly launched in 2018. 19 investigation reports were published in 2017, and thereby 15 serious incident investigations were carried over to 2019.

Among the 37 investigation reports published in 2018, one was issued with recommendations and one was issued with opinions.

Investigations of aircraft accidents and serious incidents in 2018

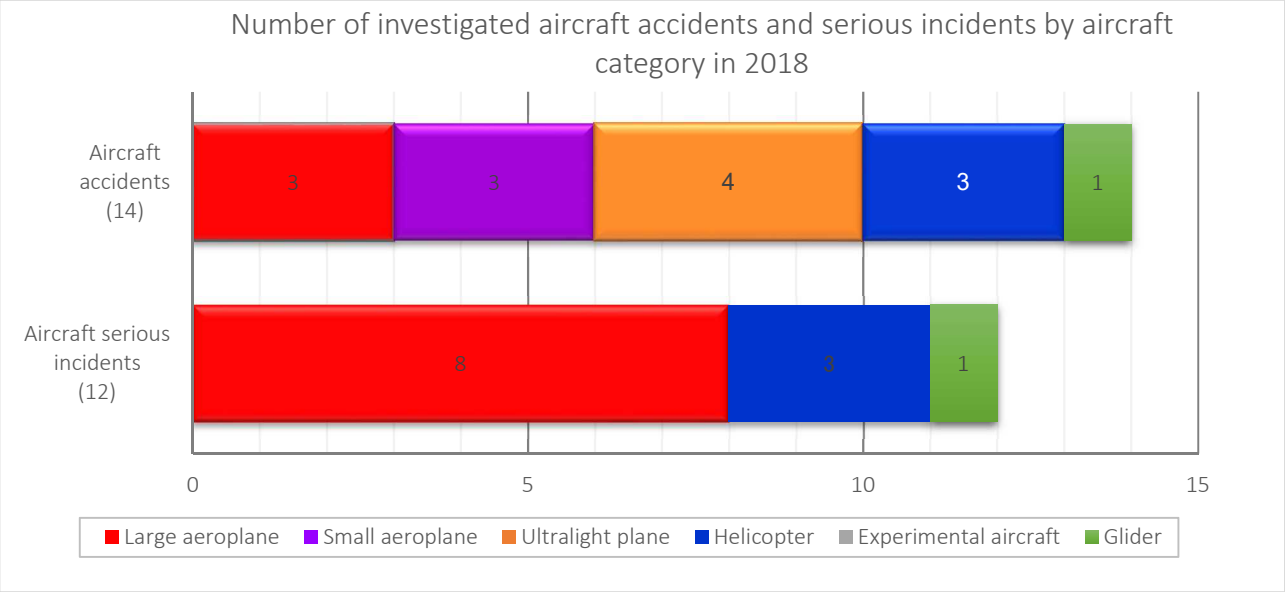
(Cases)

Category	Carried over from 2017	Launched in 2018	Total	Published investigation reports	(Recommendations)	(Safety recommendations)	(Opinions)	Carried over to 2019	(Interim report)
Aircraft accident	21	14	35	18	(1)	(0)	(1)	17	(0)
Aircraft serious incident	22	12	34	19	(0)	(0)	(0)	15	(0)

4 Statistics of investigations launched in 2018

The aircraft accidents and serious incidents that were newly investigated in 2018 consisted of 14 aircraft accidents, down six from 20 for the previous year, and 12 aircraft serious incidents, down five from 17 for the previous year.

By aircraft category, the aircraft accidents included three cases involving large aeroplanes, three cases involving small aeroplanes, four cases involving ultralight planes, three cases involving helicopters, and one case involving gliders. The aircraft serious incidents included eight cases involving large aeroplanes, three cases involving helicopters, and one case involving glider.



* Large aeroplane refers to an aircraft of a maximum take-off mass of over 5,700 kg.
* Small aeroplane refers to an aircraft of a maximum take-off mass of under 5,700 kg except for ultralight plane.

In the 14 aircraft accidents, the number of injuries was 17, consisting of 11 fatal injuries and six serious/minor injuries.

Statistics of number of injuries (aircraft accident)

(Persons)

2018							
Aircraft category	Faital Injuries		Missing		Serious/Minor Injuries		Total
	Crew	Passengers and others	Crew	Passengers and others	Crew	Passengers and others	
Large aeroplane	0	0	0	0	2	0	2
Small aeroplane	0	0	0	0	0	0	0
Ultralight plane	2	0	0	0	1	1	4
Helicopter	1	8	0	0	1	0	10
Experimental aircraft	0	0	0	0	0	0	0
Glider	0	0	0	0	1	0	1
Total	3	8	0	0	5	1	17
	11		0		6		

*The above statistics include incidents under investigation so may change depending on the status of the investigation and deliberation. In addition, for the number listed as “passengers” on the website in the number of injuries of an aircraft accident currently under investigation, the minimum number of pilots required to fly the aircraft are counted as “crew”.

5 Summaries of aircraft accidents and serious incidents which occurred in 2018

The aircraft accidents and serious incidents which occurred in 2018 are summarized as follows: The summaries are based on information available at the start of the investigations and therefore are subject to change depending on the course of investigations and deliberations.

(Aircraft accidents)

1	Date and location	Operator	Aircraft registration number and aircraft type
	April 9, 2018 Runway B at Kansai International Airport, Osaka Prefecture	Korean Airlines Co., Ltd	HL7725 Boeing 737-900 (Large aeroplane)
	Summary	The aircraft took off from Jeju and then when it made a go-around at runway B at Kansai International Airport, the lower rear surface of its airframe made contact with the runway. There were no injuries.	
2	Date and location	Operator	Aircraft registration number and aircraft type
	April 15, 2018 On the sea at approximately 1.2 km off the coast of Sakaigahama, Urasaki Town, Onomichi City, Hiroshima Prefecture	Setouchi SEAPLANES Inc.	JA02TG Quest Kodiak 100 (Small aeroplane)
	Summary	See “6. Publication of investigation reports” (Page 113 No.17)	
3	Date and location	Operator	Aircraft registration number and aircraft type
	April 22, 2018 Akitakata City, Hiroshima Prefecture (34° 36’28”N, 132° 43’04”E)	Privately Owned	JR1902 Quicksilver Sport 2S-R582 (Ultralight plane)
	Summary	See “6. Publication of investigation reports” (Page 111 No.13)	
4	Date and location	Operator	Aircraft registration number and aircraft type
	June 7, 2018 On the sea at approximately 40 km northwest of Naha Airport, Okinawa Prefecture (details unknown)	Excel Air Service Inc.	JA350D Eurocopter AS350B3 (Helicopter)
	Summary	The aircraft took off from Naha Airport, reported an emergency situation during flight and then crashed near the abovementioned location. One person on board suffered minor injuries.	
5	Date and location	Operator	Aircraft registration number and aircraft type
	June 24, 2018 Approximate altitude of 9,100 m, approximately 80 km north of Sendai Airport, Miyagi Prefecture	Japan Airlines Co., Ltd.	JA8944 Boeing 777-300 (Large aeroplane)
	Summary	The aircraft took off from New Chitose Airport, and when the aircraft shook during flight near the abovementioned location, one of the cabin crew fell over and suffered serious injuries.	
6	Date and location	Operator	Aircraft registration number and aircraft type
	July 8, 2018 On land at Fuseshita, Kashiwa City, Chiba Prefecture	Privately Owned	JA7980 Robinson R22Beta (Helicopter)
	Summary	Two people, the pilot in command and a passenger, boarded the aircraft. The aircraft rolled over while traveling above the ground (air taxiing) at a temporary helipad located in Kashiwa City, Chiba Prefecture resulting in damage to the airframe.	
7	Date and location	Operator	Aircraft registration number and aircraft type
	July 14, 2018 Motoishikawa Town, Mito City, Ibaraki Prefecture	Privately Owned	JR1118 Quicksilver GT400S-447L (Ultralight plane)

	Summary	The aircraft crashed at the abovementioned location during flight, One person suffered fatal injuries.	
8	Date and location	Operator	Aircraft registration number and aircraft type
	July 25, 2018 Approximate altitude of 90 m, approximately 1 km west of Kounan Airfield, Okayama Prefecture	Okayama Air Service Co., Ltd.	JA10AZ Cessna 172R (Small aeroplane)
	Summary	The aircraft was approaching the airfield during a training flight and collided with a bird resulting in damage to the airframe. A total of 3 people, the pilot in command and 2 students were on the plane but there were no injuries.	
9	Date and location	Operator	Aircraft registration number and aircraft type
	August 10, 2018 In the mountains of Nakanojo Town, Agatsuma District, Gunma Prefecture	Gunma Disaster Prevention Air Corps	JA200G Bell 412EP (Helicopter)
	Summary	The aircraft took off from Gunma Heliport and crashed in the mountains of Nakanojo Town, Agatsuma District, Gunma Prefecture during flight. Nine persons on board suffered fatal injuries in the crash.	
10	Date and location	Operator	Aircraft registration number and aircraft type
	August 21, 2018 On East Runway (Runway 18L) of Chitose Airport, Hokkaido	Japan Coast Guard	JA395A Textron Aviation 172S (Small aeroplane)
	Summary	The aircraft took off from Chitose Airport for a pilot practical test. When the pilot attempted to land on the east runway (runway 18L) of the airport, the aircraft landed with too much force and damaged the airframe. There were no injuries.	
11	Date and location	Operator	Aircraft registration number and aircraft type
	August 27, 2018 Approximate altitude of 9,100 m, approximately 60 km east of Miyazaki Airport, Miyazaki Prefecture	Vanilla Air	JA14VA Airbus A320-214 (Large aeroplane)
	Summary	The aircraft took off from Kansai International Airport and when the aircraft shook near the abovementioned location during flight, one of the cabin crew fell over and suffered serious injuries.	
12	Date and location	Operator	Aircraft registration number and aircraft type
	November 3, 2018 Near Namiki, Namegata City, Ibaraki Prefecture	Privately Owned	JR1749 Kit-Fox MODEL IV-R532L (Ultralight plane)
	Summary	The aircraft took off from a temporary airfield in Mito City, Ibaraki Prefecture and crashed at the abovementioned location around 1:40 PM during flight. Two persons on board suffered minor injuries.	
13	Date and location	Operator	Aircraft registration number and aircraft type
	November 11, 2018 Yamaga, Ubuyama, Aso District, Kumamoto Prefecture	Privately Owned	JR7366 BOGDOLA JANOS BB-02SERPA BENCE/R-R503 (Ultralight plane)
	Summary	The aircraft took off from a temporary airfield in Ubuyama, Aso District, Kumamoto Prefecture and crashed at the abovementioned location during flight. One person on board suffered fatal injuries.	
14	Date and location	Operator	Aircraft registration number and aircraft type
	December 9, 2018 Menuma Glider Airstrip, Kumagaya City, Saitama	Privately Owned	JA2152 Alexander Schleicher ASK 13

	Prefecture		(Glider)
	Summary	After taking off from Menuma Glider Airstrip the aircraft was unable to ascend and landed nose-first into the ground, resulting in damage to the airframe. One passenger suffered serious injuries.	

(Aircraft serious incidents)

1	Date and location	Operator	Aircraft registration number and aircraft type
	March 18, 2018 On Naha Airport Runway 18, Okinawa Prefecture	Juneyao Airline Co, Ltd. (Aircraft A)	B8236 Airbus A320-214 (Large aeroplane)
		Japan Coast Guard (Aircraft B)	JA8570 Dassault Falcon 900 (Large aeroplane)
	Summary	See “6. Publication of investigation reports” (Page 120 No.19)	
2	Date and location	Operator	Aircraft registration number and aircraft type
	March 24, 2018 On the Fukuoka Airport runway, Fukuoka Prefecture	Peach Aviation Limited	JA805P Airbus A320-214 (Large aeroplane)
	Summary	After the aircraft landed at Fukuoka Airport, the nose landing gear tires misaligned to face sideways causing the aircraft to stop on the runway.	
3	Date and location	Operator	Aircraft registration number and aircraft type
	April 11, 2018 Approximate altitude of 170 m, approximately 8 km north east of Tokyo International Airport, Tokyo	Thai Airways	HSTGX Boeing 747-400 (Large aeroplane)
	Summary	The aircraft took off from Bangkok. While it was approaching runway C at Tokyo International Airport an alarm operated from the ground proximity warning system when the aircraft was near the abovementioned location. The aircraft ascended in accordance with this warning and performed a go-around. Following this, the aircraft landed on runway B at Tokyo International Airport.	
4	Date and location	Operator	Aircraft registration number and aircraft type
	May 24, 2018 Approximate altitude of 1,800 m, approximately 10 km west of Kumamoto Airport, Kumamoto Prefecture	Japan Airlines Co., Ltd.	JA8980 Boeing 767-300 (Large aeroplane)
	Summary	The aircraft took off from Kumamoto Airport and while it was ascending the first (left side) engine failed near the abovementioned location. The pilot requested priority in air traffic control, turned back and landed at the airport.	
5	Date and location	Operator	Aircraft registration number and aircraft type
	June 14, 2018 Approximate altitude of 300 m, approximately 5 km south from the Naha Airport runway approach end and on the Naha Airport runway, Okinawa	Ryukyu Air Commuter Co., Ltd. (Aircraft A)	JA84RC Bombardier DHC-8-402 (Large aeroplane)

	Prefecture	Japan Air Self-Defense Force (Aircraft B)	None F-15 (Large aeroplane)
	Summary	The air traffic controller ordered Aircraft B to wait in front of the runway. However, Aircraft B went past the stopping position at the front of the runway and entered the runway. The air traffic controller ordered Aircraft B to withdraw from the runway and also canceled landing permission for Aircraft A, which was in the process of approaching the runway.	
6	Date and location	Operator	Aircraft registration number and aircraft type
	June 29, 2018 On Narita International Airport taxiway, Chiba Prefecture	Korean Airlines Co., Ltd	HL7573 Boeing 777-300 (Large aeroplane)
	Summary	The aircraft took off from Seoul (Incheon). After landing on runway B at Narita International Airport and while traveling on the ground it stopped on the taxiway due to a damaged right main landing gear axle.	
7	Date and location	Operator	Aircraft registration number and aircraft type
	July 8, 2018 Approximate altitude of 4,500 m, approximately 20 km south east from Toyama Airport, Toyama Prefecture	China Airlines	B18667 Boeing 737-800 (Large aeroplane)
	Summary	The aircraft took off from Taipei. It attempted to land 3 times at Toyama Airport but was unable to land due to the effects of airflow and then changed its destination to Chubu International Airport. The aircraft's remaining fuel was low near the abovementioned location so the pilot requested priority in air traffic control, and landed at the airport.	
8	Date and location	Operator	Aircraft registration number and aircraft type
	July 9, 2018 On the Toyama Airport runway, Toyama Prefecture	Aero Asahi Corporation	JA9690 AEROSPATIALE AS332L (Helicopter)
	Summary	The aircraft landed on a runway at Toyama Airport that was being used by a runway inspection vehicle.	
9	Date and location	Operator	Aircraft registration number and aircraft type
	August 21, 2018 Approximate height of 130 m above and near Fukushima Town, Matsumae District, Hokkaido	Nakanihon Air Service Co., Ltd.	JA9660 AEROSPATIALE AS332L (Helicopter)
	Summary	The aircraft took off from a temporary helipad in Fukushima Town, Matsumae District, Hokkaido. While transporting goods suspended from the aircraft, it dropped some of the goods (2 lengths of wire weighing 52 kg and 13 kg and a single blue sheet weighing 3 kg) at the abovementioned location.	
10	Date and location	Operator	Aircraft registration number and aircraft type
	September 26, 2018 Anamizu Town, Hosu District, Ishikawa Prefecture	Japan Aviation Academy	JA2451 Valentin Taifun 17E II (Glider)
	Summary	The aircraft took off from Noto Airport to verify flight prior to an airworthiness inspection. During flight, an electrical systems fault occurred and the pilot attempted to turn back by gliding to Noto Airport but had to perform an emergency landing on grassland approximately 3 km before the airport. This resulted in the damage to the legs on the glider making it impossible to navigate.	

11	Date and location	Operator	Aircraft registration number and aircraft type
	October 20, 2018 Approximate height of 900 m above and near Minamidaio, Otoyo Town, Nagaoka District, Kochi Prefecture	Nishi Nippon Airlines Co., Ltd.	JA003W Bell 412EP (Helicopter)
	Summary	The aircraft took off from a temporary helipad in Otoyo Town, Nagaoka District, Kochi Prefecture. While transporting goods suspended outside the aircraft, it dropped the goods (ready-mixed concrete weighing 600 kg) in the mountains near the abovementioned location.	

12	Date and location	Operator	Aircraft registration number and aircraft type
	October 27, 2018 Approximate altitude of 120 m, approximately 2.4 km north east of Tokyo International Airport and on runway B at Tokyo International Airport, Tokyo	Privately Owned (Aircraft A)	B3276 Gulfstream Aerospace G650 (Large aeroplane)
		Okayama Air Service (Aircraft B)	JA123F Cessna 510 (Small aeroplane)
	Summary	Aircraft B received permission to land and was approaching runway B at Tokyo International Airport. Aircraft A, which was instructed to stop before runway B and was traveling on the ground, entered runway B. This resulted in the traffic controller instructing Aircraft B to make a go-around.	

6 Publication of investigation reports

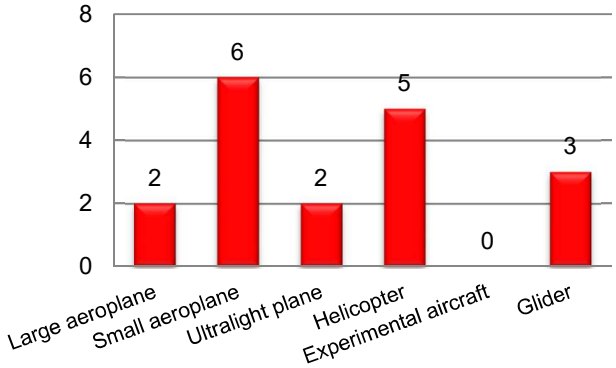
The number of investigation reports of aircraft accidents and serious incidents published in 2018 was 37, consisting of 18 aircraft accidents and 19 aircraft serious incidents.

Breaking them down by aircraft category, the aircraft accidents involved two large aeroplanes, six small aeroplanes, two ultralight planes, five helicopters, and three gliders. The aircraft serious incidents involved eight large aeroplanes, three small aeroplanes, and eight helicopters.

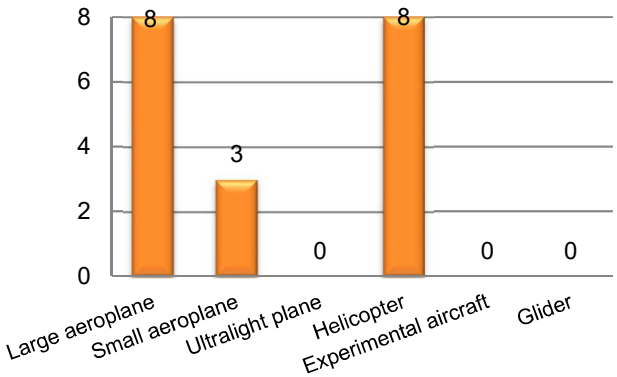
Note: In aircraft accidents and serious incidents, two or more aircraft are sometimes involved in a single case. See page 106 to 122 for details.

In the 18 accidents, the number of injuries was 61, consisting of 16 fatal injuries, and 45 serious/minor injuries.

Number of published aircraft accident reports (18 cases) by aircraft category in 2018

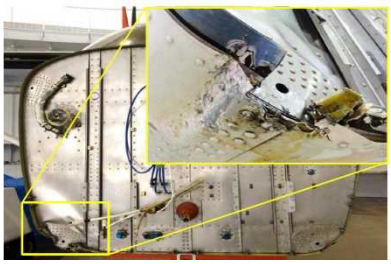


Number of published aircraft serious incident reports (19 cases) by aircraft category in 2018



The aircraft accidents and serious incidents which occurred in 2018 are summarized as follows.

Aircraft accident investigation reports published in 2018

1	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	January 25, 2018	April 15, 2017 Lake Shinji, Tamayu Town, Matsue City, Shimane Prefecture	Privately Owned	JA007P Cessna T206H
	Summary	The aircraft suffered damage due to a collision with wave during takeoff run from water at Lake Shinji, heading to Tottori Airport for a familiarization flight. 		
	Probable Causes	In this accident, it is highly probable that the Aircraft suffered damage because it collided with big wave during the takeoff run from water. Regarding to the collision with big wave during the takeoff run from water, it is probable that because the Pilot did not check the performance to takeoff from water in POH in advance and commenced the takeoff run from water without securing the required takeoff distance from water, and because the Pilot thought that becoming airborne was imminent when approaching the rough water area, he did not reject the takeoff from water before the collision with big wave.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA007P.pdf		
2	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	February 22, 2018	March 24, 2017 At the Sea off Beppu City, Oita Prefecture	Setouchi SEAPLANES, Inc.	JA02TG Quest Kodiak 100
	Summary	The aircraft took bounces during the takeoff run from water and suffered damage to the aircraft when contacting water surface.		
	Probable Causes	It is highly probable that because the Aircraft bounced during the takeoff run from water and received strong impact when contacting water surface, and suffered damage to the Aircraft. Regarding the Aircraft bounced during the takeoff run from water, it is probable that because the Pilot conducted the takeoff run from water across the swell at the sea area existing the wind wave and swell, pitching motion was generated and the amplitude become larger along with the acceleration. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA02TG.pdf		
3	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	March 29, 2018	June 29, 2018 Nagasaki Airport, Nagasaki Prefecture	School Judicial Organization KIMIGAFUCHI GAKUEN (Sojo University)	JA5304 Beechcraft 58
	Summary	The aircraft made a belly landing which caused damages to the aircraft at Nagasaki Airport during a training flight.		
	Probable Causes	It is probable that the accident occurred because the Aircraft touched down without extending the landing gears which resulted in a belly landing and suffered the damages to the Aircraft.		

<table>
<tr><td></td><td></td><td colspan="3">Regarding the reason why the Aircraft touched down without extending the landing gears, it is probable that it was caused by the followings.
1. The Captain did not notice that the Trainee did not lower the landing gears and did not recheck the landing gear-down, because the Captain was less attentive to monitor the other handling of the Trainee than the controlling the Aircraft.
2. The trainee was distracted by the short field landing procedures and the control of the Aircraft and forgot to lower the landing gear and re-confirm it.
  </td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA5304.pdf</td></tr>
<tr><td>4</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td></td><td>March 29, 2018</td><td>August 9, 2016
Shichi-ga-hama Town, Miyagigun, Miyagi Prefecture</td><td>Japan Coast Guard</td><td>JA968A
Agustawestland AW139</td></tr>
<tr><td></td><td>Summary</td><td colspan="3">The aircraft landed on the sandy beach at Hanabuchi-hama of Shichi-ga-hama Town, Miyagigun, Miyagi Prefecture, Japan, without extending the landing gear down and suffered damages to the rotorcraft.</td></tr>
<tr><td></td><td>Probable Causes</td><td colspan="3">It is highly probable that this accident occurred as the Rotorcraft suffered damages because it had landed without extending the landing gear.
Regarding why it had landed without extending the landing gear, it is probable that various tasks were occurred in short time span and at same time other crews on board were also focusing on their own various tasks, so that they could not carry out necessary corporation or support, and because the workload of the captain continued to be high, there were not enough time for the captain to shift his mind from the rescue operation to the landing procedure, as the result, he forgot the check prior to the landing prescribed in the flight manual and did not check the landing gear condition.
  </td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA968A.pdf</td></tr>
<tr><td>5</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td></td><td>June 28, 2018</td><td>August 25, 2016
Sendai Airport</td><td>Independent Administrative Institution Civil Aviation College</td><td>JA5807
Hawker Beechcraft G58</td></tr>
<tr><td></td><td>Summary</td><td colspan="3">The aircraft made a belly landing on the Runway 27 at Sendai Airport which caused damage to the aircraft during a training flight.</td></tr>
<tr><td></td><td>Probable Causes</td><td colspan="3">In this accident, it is certain that the aircraft made a belly landing both without extending the landing gears and without the sufficient confirmation of the status during the touch-and-go training at Sendai Airport, and which caused damage to the aircraft.
Regarding that the aircraft made a landing both without extending the landing gears and without the sufficient confirmation of the status; it is probable that the Instructor was not aware of his forgotten of both the operation to extend the landing gears and the confirmation because the grasp of flight situation by the Instructor became insufficient.
  </td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA5807.pdf</td></tr>
</table>

<table>
<tr><td rowspan="4">6</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td>June 28, 2018</td><td>August 27, 2017
Fukushima</td><td>Fukushima Motor Glider Club</td><td>JA2406
Hoffmann H-36 Dimona (glider)</td></tr>
<tr><td>Summary</td><td colspan="3">The aircraft took off from Fukushima Sky Park and the motor glider crashed while it was flying in the vicinity of Bandai-Azuma Skyline Fudosawa Bridge.
The captain suffered fatal injuries and the passenger suffered serious injuries. The aircraft was destroyed.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">In this accident, it is highly probable that the aircraft entered into the valley at insufficient altitude and when it approached the mountain slope, the captain made a steep turn to avoid a collision with the slope, but with the insufficient airspeed the aircraft stalled and fell into the spin and crashed.
  </td></tr>
<tr><td rowspan="4">7</td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA2406(2).pdf</td></tr>
<tr><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td>June 28, 2018</td><td>November 10, 2017
Ono Gliding Field, Ono-Cho, Ibi-Gun, Gifu Prefecture</td><td>Kwansei Gakuin University</td><td>JA05KG
Schempp-Hirth V.L. Discus CS (glider)</td></tr>
<tr><td>Summary</td><td colspan="3">The aircraft aborted a winch launching for a familiarization flight and collided with the winch while landing, resulting in damage of the aircraft.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">In this accident, it is probable that since the Glider became difficult to control after aborting the winch launching and landing was attempted, the right main wing collided with the winch, and then the Glider was damaged due to the impact force produced when it stopped upside-down.
It is probable that the cause why the Glider became difficult to control is that the Pilot could not appropriately control the approaching angle and speed since she did not open the air brakes, and then the flare and other controls by the Pilot were overcontrolled and it caused PIOs (Pilot-Induced Oscillations).
  </td></tr>
<tr><td rowspan="4">8</td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA05KG.pdf</td></tr>
<tr><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td>July 26, 2018</td><td>May 27, 2016
Runway 34R at the Tokyo International Airport</td><td>Korean Airlines Co.,Ltd</td><td>HL7534
Boeing 777-300</td></tr>
<tr><td>Summary</td><td colspan="3">The aircraft as the scheduled Flight 2708 of the company, flight crew had a rejected takeoff on runway 34R at the Tokyo International Airport during a takeoff roll to Gimpo International Airport, because there was a warning to indicate a fire from the No.1 (left-side) engine activated at around 12:38, the flight crew stopped the aircraft on the runway, and conducted an emergency evacuation. There were 319 people in total on board, consisting of the PIC, sixteen other crew members, and 302 passengers. Among them, 40 passengers suffered minor injuries.</td></tr>
</table>

	Probable Causes	It is highly probable that the causes of this accident were the fracture of the high pressure turbine (HPT) disk of the No.1 (left-side) engine during the takeoff ground roll of the HL7534, the penetration of the fragment through the engine case and the occurrence of subsequent fires. Regarding the cause for the 1st stage HPT disk to be fractured, it is probable that a step was machined exceeding the allowable limit when machining U-shaped groove on the aft side of the 1st stage HPT disk to manufacture the engine and from this step the low-cycle fatigue cracks were initiated and propagated during running of engine. Regarding why the step could not be found, it is somewhat likely that defects failed to be detected at the time of the inspection by the manufacturer during the production process. And as for the cracks that were not found, it is somewhat likely that those cracks failed to be detected at non-destructive inspection on the disk by the Korean Airlines Co., Ltd , at the time of maintenance of the engine in use. Regarding the fire breakout from the No.1 engine, it is probable that due to the impact forces generated by the release of the fragment from the ruptured rim part of the 1st stage HPT disk through the engine case and the engine rundown loads generated when the engine stopped suddenly, the cracks were developed in the outer case of the Fuel Oil Heat Exchanger and the fuel and engine oil leaking through these cracks contacted the hot area of engine case of the No.1 engine to be ignited.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/HL7534.pdf http://www.mlit.go.jp/jtsb/aircraft/p-pdf/AA2018-5-2-p.pdf (Explanatory material) See “Feature 2: Summaries of major aircraft accident and serious incident investigation reports (case studies)”, page 38		
9	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	July 26, 2018	September 10, 2017 Yamaoka Town, Ena City, Gifu Prefecture	Privately Owned	JR1925 Quicksilver MXLIITop-R582L NISHIYAMA (Ultralight plane)
	Summary	The aircraft had one passenger including the pilot for a familiarization flight. It took off from a temporary airfield in Yamaoka Town, Ena City, Gifu Prefecture. While ascending and turning, the aircraft suddenly lost altitude unintentionally and made contact with nearby forest trees. After which the aircraft dropped to the ground resulting in damage to the airframe.		
	Probable Causes	In this accident, it is probable that when the aircraft attempted to turn at low speed and low altitude it encountered air turbulence or stalled, which caused the aircraft to suddenly lose altitude and crash. The reason that the pilot attempted to turn while at low speed and low altitude is probable thatthe pilot had no experience of the aircraft and flew the aircraft without full knowledge of its performance contributed to it.		
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-acci/AA2018-5-1-JR1925.pdf		
10	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	August 30, 2018	March 18, 2017 Odaira, Itoigawa City, Niigata	Privately Owned	JA7907 Robinson R44

		Prefecture		
	Summary	The aircraft contacted with a snowy slope upon landing at The Temporary Airfield, in Odaira, Itoigawa City, Niigata Prefecture and rolled over. Its airframe was damaged.		
	Probable Causes	In this accident, it is highly probable that upon landing, the Rotorcraft touched the snowy slope short of the Helipad, rolled over and its airframe was damaged. It is probable that the reason the Rotorcraft touched the snowy slope is because the PIC tried to land by taking a steep left turn and nose-diving, neglecting the safety of flight. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA7907.pdf		
11	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	August 30, 2018	June 3, 2017 Ashikuraji, Tateyama Town, Nakaniikawa District, Toyama Prefecture	New Central Airservice Co.,Ltd.	JA3989 Cessna 172P
	Summary	The aircraft took off from Toyama Airport, while flying to Matsumoto Airport, at around 14:50 Japan Standard Time (JST: UTC+9 hours, unless otherwise stated all times are indicated in JST), it crashed into the vicinity of the top of Mt. Shishi-dake (elevation about 2,700 m) in the Tateyama Mountain Range. There were four people on board the Aircraft consisting of a PIC, a pilot and two passengers and all of them suffered fatal injuries. The aircraft was destroyed but there was no outbreak of fire. 		
	Probable Causes	It is probable that as the Aircraft got into clouds during VFR flight over the mountain region, it became difficult for the PIC and the Pilot to grasp its own position and surroundings by confirming visually the terrain, then, the Aircraft approached the vicinity of the mountaintop and crashed into it. It is somewhat likely that the Aircraft approached the vicinity of the mountaintop and crashed into it due to loss of visual contacts making the crash unavoidable, or due to failure to maintain minimum safe altitude caused by the Aircraft icing or stalled condition, or due to encountering a severe turbulence. However, it could not be determined, since the PIC and all members on board suffered fatal injuries. Concerning the fact that the Aircraft came to fly into clouds, it is probable that the PIC and the Pilot had not confirmed thoroughly the weather forecast for the mountainous region before departure and they delayed in making a decision to turn back during flight.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA3989.pdf http://www.mlit.go.jp/jtsb/aircraft/p-pdf/AA2018-6-2-p.pdf (Explanatory material) See “Feature 2: Summaries of major aircraft accident and serious incident investigation reports (case studies)”, page 40		
12	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	September 27, 2018	July 1, 2017 Approximate altitude of 15,600 feet, approximately 64 km south west of Fukushima Airport, Fukushima Prefecture	United Airlines, Inc.	N29968 Boeing 787-9 (Large aeroplane)

	Summary	The aircraft was flying towards Tokyo International Airport from San Francisco International Airport as the regular 875 flight from United Airlines. During flight the aircraft shook and a cabin crew member suffered serious injuries.		
	Probable Causes	In this accident, it is highly probable that one of the cabin crew members suffered serious injuries after falling over while working at the rear galley because the aircraft shook while the aircraft was descending inside a cloud region near a stationary weather front.		
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-acci/AA2018-7-1-N29968.pdf		
13	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	September 27, 2018	April 22, 2018 Akitakata City, Hiroshima Prefecture (north latitude of 34 degrees 36 minutes 28 seconds, east longitude of 132 degrees 43 minutes 04 seconds)	Privately Owned	JR1902 Quicksilver Sport 2S-R582 (Ultralight plane)
	Summary	The aircraft took off from a temporary airfield in Toyosaka, which is in Akitakata City, Hiroshima Prefecture, with only the pilot on board for the purpose of leisure. While flying above Misasa River, which flows through the town, the aircraft made contact with an overhead ground wire installed above electric cables, which caused the aircraft to crash into a field. The aircraft suffered fatal damage but the pilot suffered no injuries. 		
	Probable Causes	In this accident, it is highly probable that the aircraft crashed after making contact with overhead ground wire because it was flying at low altitude.		
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-acci/AA2018-7-2-JR1902.pdf		
14	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	October 25, 2018	March 5, 2017 Mt. Hachibuse, Matsumoto City, Nagano Prefecture	Nagano Fire and Disaster Prevention Aviation Center	JA97NA Bell 412EP
	Summary	The aircraft took off from Matsumoto Airport and was flying toward a temporary helipad in the mountains, Shiojiri City, Nagano Prefecture to conduct rescue training. At around 13:41, it collided with trees and then crashed onto the mountain's slope on Mt. Hachibuse, Matsumoto City, Nagano Prefecture. There were nine persons on board the helicopter, consisting of a captain, eight others and all of them suffered fatal injuries. The helicopter was destroyed, but there was no outbreak of fire. 		
	Probable Causes	It is highly probable that in the accident occurred, while flying in a mountainous region, the helicopter collided with trees and crashed, because the helicopter did not take avoidance maneuver even getting closer to the ground. Regarding the helicopter's not taking avoidance maneuver even getting closer to the ground while flying in a mountainous region, it is somewhat likely that the captain could not recognize the dangerous situation because the captain was in a state where the arousal level was lowered, however, it was not possible to clarify whether he actually fell into such a state.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA97NA.pdf http://www.mlit.go.jp/jtsb/aircraft/p-pdf/AA2018-8-1-p.pdf (Explanatory material) See "Feature 2: Summaries of major aircraft accident and serious incident investigation		

		reports (case studies)", page 39		
15	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	October 25, 2018	March 14, 2017 Kobe Airport	HIRATA GAKUEN	JA500H Eurocopter AS350 B3
	Summary	The aircraft landed on a grass area inside the landing area of Kobe Airport and attempted to lift off again for training but rolled over in the same grass area. There were 2 people on board the helicopter, consisting of a PIC and a pilot undergoing annual training. There were no injuries. The helicopter was destroyed, but there was no outbreak of fire.		
	Probable Causes	It is probable that this accident occurred because, when control was transferred from the pilot in the right seat to the Pilot In Commander in the left seat immediately after the helicopter made a running landing in hydraulic system failure training and the helicopter attempted to lift off again, left rotation occurred and the helicopter rolled over to the right due to dynamic rollover in which the trailing end of the right skid, which became stuck in the ground, served as the fulcrum, causing damage to the helicopter. Regarding the left rotation, it is probable that this occurred because the collective pitch lever rose after the transfer of control and appropriate control in response to it did not take place. It is probable that the fact that an operation to restore hydraulic pressure was being conducted simultaneously with the transfer of control and the fact that the collective pitch lever was not being held appropriately contributed to the collective pitch lever's rise.  		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA500H.pdf		
16	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	November 29, 2018	May 14, 2017 Tabayama Village, Kitatsuru-Gun,Yamanashi Prefecture	Yamanashi Prefectural Police Headquarters	JA110Y Bell 412EP
	Summary	The aircraft conducted a rescue operation when one rescuee suffered fatal injuries and three search and rescue (SAR) team members suffered minor injuries.		
	Probable Causes	In this accident, it is highly probable that when the helicopter made the approach to the survivor during rescue activities in the mountains, the tree branches were broken and the rockfalls occurred due to the downwash, and some of those falling trees and rocks hit the survivor and the SAR team members. Regarding the occurrence of falling rocks and broken tree branches, it is somewhat likely that the those facts—which the rescue site was steep and narrow V-shaped trough-like terrain and the helicopter made the approach at a slow speed and at a shallow angle toward the rescue position —may have contributed to the situation where the flow direction and speed significantly changed. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA110Y.pdf http://www.mlit.go.jp/jtsb/aircraft/p-pdf/AA2018-9-1-p.pdf (Explanatory material)		
17	Date of	Date and location	Operator	Aircraft registration number

	Publication			and aircraft type
	November 29, 2018	April 15, 2018 At The Sea Surface About 1.2 Km Off Sakaigahama Urasaki Town, Onomichi City, Hiroshima Prefecture, Japan	Setouchi SEAPLANES Inc.	JA02TG Quest Kodiak 100
	Summary	The aircraft repeated bounce during the water landing and suffered damage to the aircraft.		
	Probable Causes	It is probable that in this accident, the Aircraft touched down so hard, while repeating the bounce after the Pilot rejected the go-around, and suffered damage to the Aircraft. It is probable that the reason why the Aircraft touched down so hard while repeating the bounce was that the Pilot was not able to stabilize the Aircraft during bounce by increasing / reducing the power and setting the nose attitude, and continued the same control without making a go-around.  		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA02TG%20(2).pdf		
18	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	December 20, 2018	October 10, 2016 Oizumi Town, Oura-Gun, Gunma Prefecture	Waseda University	JA22WP Rolladen-Schneider LS4-b (glider)
	Summary	The aircraft was winch-launched from the Menuma Gliding Field at Kumagaya City in Saitama Prefecture for the gliding competition and crashed along the airfield traffic pattern while trying to land. The Pilot died and the glider was destroyed.		
	Probable Causes	It is highly probable that in spite of the control to recover from the stall at low altitude, the Glider stalled again; started spinning and crashed. It is somewhat likely that the Glider stalled at low altitude because of the steep turn at low speed and that the stall was attributable to the Pilot who did not fully familiarize himself with the flight characteristics of the Glider whose CG position was set to near the aft limit position. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA22WP.pdf		

Aircraft serious incident reports published in 2018

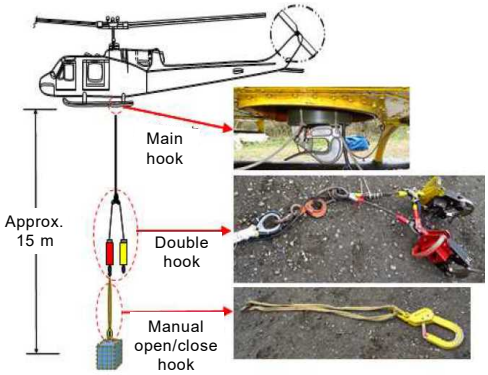
1	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	February 22, 2018	December 22, 2016 About 5 Nm East Of Tokyo International Airport, Around 480Ft	Peach Aviation Co., Ltd	JA811P Airbus A320-214
	Summary	The aircraft was the scheduled Flight 1028 of the company, while approaching runway 16L of Tokyo International Airport, mistakenly tried to approach for runway 23 which was closed at 00:39 JST. An air traffic controller in the control tower 		

		noticed the situation and instructed it to go around at the position of about 5 nm east of the airport. Afterward, the aircraft landed on runway 16L at 00:55 JST via visual approach following radar-vectored. There were 164 persons on board consisting of the captain, five other crewmembers and 158 passengers. There were no injuries on board and no damage to the aircraft.
	Probable Causes	It is probable that the serious incident occurred because aircraft, conducting VOR-A approach to land on runway 16L of Tokyo International Airport, mistakenly tried to approach for runway 23 which was closed. It is probable that the aircraft mistakenly tried to approach for runway 23 which was closed because advance preparations for VOR A approach by the captain and the first officer were not sufficient, and they could not recognize the runway change instruction to land as a threat and then they failed to manage workloads, properly monitor and advise.
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA811P.pdf

2	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	February 22, 2018	January 19, 2017 Near The End Of The Runway 01R At New Chitose Airport, Hokkaido, Japan	ANA Wings CO., LTD.	JA461A Bombardier DHC-8-402
	Summary	The aircraft took off from Akita Airport as a scheduled flight 1831 of ALL NIPPON AIRWAYS CO., LTD. as the joint undertaking for transport with ANA Wings, overran and came to a halt at the snow covered grassland when landing at New Chitose Airport.		
	Probable Causes	In this serious incident, it is highly probable that the aircraft overran the runway because the aircraft could not obtain the braking force due to the delay of braking operation start by the PIC and PL (Power Lever) was not set at the Disc position. Moreover, it is somewhat likely that the bad conditions with snow fall around the end of the runway and the overrunning zone contributed to the aircraft overrunning. Regarding the delay of braking operation start by the PIC, it is highly probable that because the PIC instructed from ATC to vacate from Taxiway B2 at the end of the runway tried to vacate the runway in a short time by delaying the braking operation start. Furthermore, it is probable that the PIC's misconceiving Taxiway B3 where he just started to vacate as Taxiway B4 contributed to it. Regarding why the PL was not set to Disc position, it is probable that because the PIC mistook the PL was already Disc position. Furthermore, it is somewhat likely that it was contributed that the co-pilot did not notice PL in different position than normal.		
				
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA461A.pdf http://www.mlit.go.jp/jtsb/aircraft/p-pdf/AI2018-1-3-p.pdf (Explanatory material) See "Feature 2: Summaries of major aircraft accident and serious incident investigation reports (case studies)", page 41		

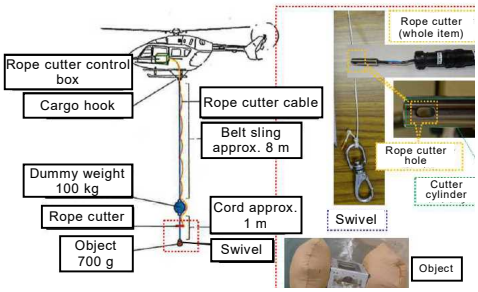
3	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	February 22, 2018	October 27, 2016 Sakae Village, Shimominochi District, Nagano Prefecture	Akagi Helicopter Co., Ltd.	JA9374 Fuji-Bell 204B-2 (Helicopter)
	Summary	The aircraft was flying towards a temporary helipad at Kiriake, Sakae Village, Shimominochi District, Nagano Prefecture. During flight the aircraft dropped the goods it was carrying in the mountains nearby.		

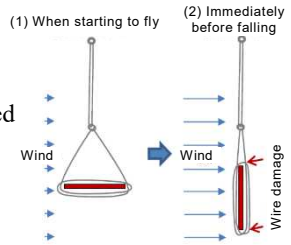
	Probable Causes	In this serious incident, it is highly probable that the aircraft dropped the goods because the double hooks opened while the aircraft was transporting the suspended goods. The reason the double hooks opened is because the double hook device main-switch was located at the ARM position, and the pilot in command, in an attempt to relax his body while flying the aircraft, moved his upper body forward and swung his left arm outwards in an up-down motion. This resulted in his arm making contact with the operation switch guard, causing the guard to open and the operation switch to operate. It is probable that the device main-switch was at the ARM position because operating procedures to turn off the main-switch to ensure the hook does not operate even when the operation switch is mistakenly operated were not specified in the company's work standards.
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-inci/AI2018-1-2-JA9374.pdf



4	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	March 29, 2018	February 14, 2017 On Runway 34R At Narita International Airport	Thai Air Asia X (Aircraft A)	HS-XTC Airbus A330-343X
			China Airlines (Taiwan) (Aircraft B)	B-18361 Airbus A330-302
	Summary	The Aircraft A crossed Holding Position Marking and entered onto the runway, despite an instruction to hold short of runway given by Aerodrome Control Facility. Because of this, the Aircraft B, approaching to land with the Landing Clearance, made a go-around as being instructed by Aerodrome Control Facility.		
	Probable Causes	It is highly probable that this serious incident occurred because the Aircraft A entered the runway across the Stop Line despite the instruction given to it by the Tower to hold short of the Stop Line of the runway 34R, and the Aircraft B which had been given landing clearance attempted a landing to the same runway. It is somewhat likely that the Aircraft A entered the runway when the PIC and the FO failed to notice the Stop Line and the Runway Guard Lights because they were concentrating to operate the switches in the cockpit and forgot to pay attentions to the outside.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/HS-XTC_B-18361.pdf		

5	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	March 29, 2018	July 1, 2017 Higashidori Village, Shimokita District, Aomori Prefecture	Japan Aerospace Exploration Agency	JA21RH Kawasaki BK117C-2 (Helicopter)
	Summary	The aircraft was flying towards a drop site from a temporary airfield in Higashidori Village, Shimokita District, Aomori Prefecture to perform a drop test for a suspended object. During flight the aircraft dropped the object on the beach.		

	Probable Causes	In this serious incident, it is highly probable that the object fell down to the ground because the rope suspending the object was cut during the flight. It is probable that the rope was cut because the rope swung in circles and rubbed against the edge of the rope cutter hole, which had sharp edges because it was not chamfered. The rope swung in circles due to the severe shaking and rotation on the object caused by strong winds while flying. 
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-inci/AI2018-2-2-JA21RH.pdf

6	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	May 31, 2018	August 5, 2016 Totsugawa Village, Yoshino-Gun, Nara Prefecture	AERO ASAHI Corporation	JA9678 Aèrospatiale AS332L1
	Summary	The Aircraft slung a steel plate at a temporary helipad in Oto Town, Gojo City, Nara Prefecture, and as heading to a construction site in Totsukawa Village, the same prefecture, dropped the steel plate slung from the rotorcraft during this flight into mountains of the same village.		
	Probable Causes	It is probable that the steel plate of being held horizontally was turned up vertically due to effects of wind pressure and others, resulted in the balance loss and dropped. It is probable that the lashing method of this steel plate was adopted because of insufficient technical examination and overlooking the possibility of suspended load collapse. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA9678(2).pdf		

7	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	May 31, 2018	April 27, 2017 Toubetsu, Tesikaga Town, Kawakami-Gun, Hokkaido	akanihon Air Service CO., LTD.	JA9743 Aerospatiale AS350B1
	Summary	The Aircraft was flying toward a cargo sling point after spraying fertilizer to a pasture at Toubetsu, Teshikaga Town, Kawakami-gun, Hokkaido by a spraying device slung outside of the rotorcraft to a temporary helipad, the spraying device was dropped.		
	Probable Causes	It is highly probable that the serious incident occurred because when the cargo swing was shaken due to the right turn following the acceleration of the rotorcraft to cause the outer cable of the cargo swing broke, the tension was applied to the inner cable, the release unit was activated to open the hook and the spraying device slung was dropped. Regarding why the outer cable of the cargo swing broke and the tension was applied to the inner cable, it is highly probable that the cable routing configuration was differed from the regular routing configuration.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA9743.pdf		

8	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	June 28, 2018	June 27, 2017 Fukushima Airport	Privately owned	JA4010 Piper PA-46-310P
	Summary	The Aircraft damaged the nose landing gear during its landing roll on runway 01 at Fukushima Airport, therefore, the aircraft became unable to move on the Runway.		
	Probable Causes	In this serious incident, it is highly probable that the aircraft became unable to move on the runway during the landing roll because the rod end bearing of the nose landing gear actuator		

		was ruptured and consequently the nose landing gear was retracted. Regarding that the rod end bearing ruptured, it is somewhat likely that the compression load was applied to the actuator along its longitudinal direction because the nose landing gear strut leant backward from its normal fully extended position. 
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA4010.pdf

9	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	June 28, 2018	August 13, 2017 Temporary Airfield Of Akeno Sky Sports Club, Chikusei City, Ibaraki Prefecture	Privately owned (Aircraft A)	JA3353 Cessna 172 H Ram
			Privately owned (Aircraft B)	JX0157 Sakamoto SS-9 (experimental aircraft)
	Summary	The Aircraft B landed on the temporary airfield of the Akeno Sky Sports Club, Chikusei City, Ibaraki Prefecture while the Aircraft A was about to start take-off roll.		
	Probable Causes	It is probable that this serious incident was caused by the landing of the Aircraft B on the temporary runway where the Aircraft A was preparing for take-off. Regarding the fact that the Aircraft B landed on the temporary runway where the Aircraft A was preparing for take-off, it is probable that the Pilot B did not have accurate understanding of the characteristics of the temporary airfield and he considered that the Aircraft A stopped was outside of the temporary runway.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA3353_JX0157.pdf		

10	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	August 30, 2018	August 3, 2017 Kurobe City, Toyama Prefecture (36°48' 59" N, 137°36' 12" E)	Aero Asahi Corporation	JA6512 Eurocopter AS350B3
	Summary	The Aircraft took off from Otosawa Temporary Helipad in Kurobe City, Toyama Prefecture, slung the external cargo at the cargo loading site of the temporary helipad and flew to the cargo unloading site on the left bank of the Kuronagi-Kitamata Dam. During the flight, the suspended object dropped in the mountain forest.		
	Probable Causes	In this serious incident, it is somewhat likely that the slinging load dropped, since the lock on the sub-hook of the external cargo sling system was unintentionally released and its load beam was opened during the external cargo sling operation. However, the probable cause of opening the load beam due to unlocking the sub-hook could not be determined.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA6512.pdf		

11	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	August 30, 2018	July 9, 2016 At an altitude of 37,000ft and approximately 96km south-southeast of Chubu Centrair International Airport	Jetstar Japan Co., Ltd.	JA04JJ Airbus A320-232
	Summary	The Aircraft was flying as a regularly scheduled 502 flight of the company, which departed from Fukuoka Airport and was heading to Narita International Airport. When the aircraft was flying at an altitude of 37,000ft and approximately 96km south-southeast of Chubu Centrair International Airport, the airspeed indication temporarily failed on the Captain's side and the Co-Pilot's side. After that, the aircraft descended to an altitude of 25,000ft and continued flight. It landed at Narita International Airport at 10:26. There were 156 persons on board consisting of the captain, five other crewmembers, and 150		

		passengers. There were no injuries. There was no damage to the aircraft.
	Probable Causes	It is probable that this serious incident occurred because the icing occurred in the Pitot tube when the aircraft was flying at an altitude of 37,000ft, which led to the temporary failure of airspeed indication on the Captain's side and Co-Pilot's side.  It is somewhat likely that the icing of the Pitot tube occurred because the aircraft flew in an ice crystal area that was existing in the vicinity of a cumulonimbus that grew to a high altitude.
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA04JJ.pdf

12	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	August 30, 2018	October 15, 2017 At an altitude of about 300 M and 4 Km northwest of Fukui Airport	Privately owned	JA3842 Beechcraft A36
	Summary	The Aircraft made a forced landing and ditched in the river due to continuous loss of engine power while flying at an altitude of about 300 m about four km northwest of Fukui Airport.		
	Probable Causes	In this serious incident, it is probable that because the fuel quantity in the right tank being selected had been significantly reduced, the fuel was not supplied and the engine rpm dropped, the situation was not improved even after switching the fuel selector valve, and the state of loss of the power went on.  Regarding the fuel quantity in the right fuel tank significantly reduced, it is probable that because the Pilot had not visually confirmed the fuel quantity during the exterior inspection, and the awareness for the fuel quantity indicators reduced during the flight, the right fuel tank continued to feed fuel, while the Pilot did not grasp the remaining quantity of fuel in the right tank.		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA3842.pdf		

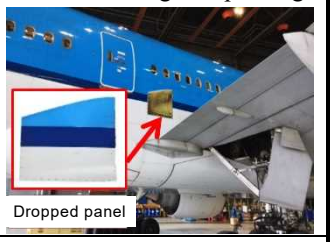
13	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	September 27, 2018	May 27, 2016 Tokyo International Airport	All Nippon Airways Co., Ltd.	JA85AN Boeing 737-800
	Summary	The Aircraft took off from Tokyo International Airport as scheduled flight 561 but, as it was climbing, turned back at 08:27 because there was a warning indicating a drop in cabin pressurization and landed at 09:11. Upon detailed inspection of the same aircraft, no damage to the aircraft was observed; however, it was found that both valves for the intake of bleed air from the left and right engines into the respective air conditioning packs had temporarily malfunctioned and were closed. There were 170 people on board the aircraft, consisting of a Captain, five other crewmembers, and 164 passengers. One passenger suffered minor injuries.		
	Probable Causes	It is highly probable that this serious incident occurred when, as the aircraft was being continuously operated without a malfunction involving temporary shutdowns of the left air conditioning pack being perceived by the flight crewmembers or mechanics, the left air conditioning pack shut down at the time of the flight's take off and then the right air conditioning pack, which had the same service hours and service environment, also shut down, and as a result pressurization was not maintained. It is probable that the left and right air conditioning packs shut down because, in both cases, the reference regulators inside the valves that control airflow to the air conditioning packs (eFCV) were stuck, and as a result the eFCVs closed from the rising bleed pressure and air was not		

		supplied to the air conditioning packs.
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA85AN.pdf

14	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	September 27, 2018	October 7, 2017 Over Sanjo City, Niigata Prefecture	Tohoku Air Service Co., Ltd.	JA6620 Kawasaki BK117B-2 (Helicopter)
	Summary	The aircraft was flying over the mountain forest in Sanjo City, Niigata Prefecture. During flight the bucket suspended outside the aircraft opened and dropped its content of ready-mixed concrete.		
	Probable Causes	In this serious incident, it is highly probable that the ready-mixed concrete dropped to the ground because the bucket opened unintentionally while the aircraft was flying with the ready-mixed concreted loaded in the bucket. It is highly probable that the bucket opened unintentionally because a defect that occurred previous to this incident was not identified or repaired and instead was replaced with non-genuine reverse polarity wiring. This meant that when the operator on the aircraft operated the bucket to open it at the unloading site, an electrical holding circuit used to fully open the bucket was formed inside the control circuit. However, temporary contact failure occurred in the receptacle and the bucket did not open. After this, when the aircraft was in flight, the contact recovered from the failure and energized, which caused the open/close motor to operate and drop the concrete.		
	Report	http://www.mlit.go.jp/jtsb/aircraft/rep-inci/AI2018-6-2-JA6620.pdf		

15	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	September 27, 2018	September 23, 2017 Kitagawa-village, Aki-gun, Kochi Prefecture	Nakanihon Air Service Co., Ltd.,	JA6717 Aérospatiale AS332L1
	Summary	The Aircraft dropped stones being carried in a bucket that was slung external to the aircraft immediately after taking off from a cargo sling point of the Kojima temporary helipad in Kitagawa-village, Aki-gun, Kochi Prefecture.		
	Probable Causes	It is certain that this serious incident occurred because the bucket opened and the stones dropped immediately after the Aircraft took off from the cargo sling point carrying stones in the bucket, in the reason why the onboard mechanic mistakenly operated the bucket's open/close switch instead of the transmit switch of the communication radio. 		
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/JA6717.pdf		

16	Date of Publication	Date and location	Operator	Aircraft registration number and aircraft type
	November 29, 2018	July 7, 2015 At an altitude about 33,000 Ft above sea at about 100 Km southwest of Akita Airport	Fuji Dream Airlines CO., LTD.	JA06FJ Embraer ERJ170-200STD
	Summary	The Aircraft took off from New Chitose Airport bound for Matsumoto Airport as a scheduled flight 212. While the Aircraft was climbing in airspace approximately 33,000 ft at around 100 km southwest of Akita Airport, the supply of the bleed air stopped in both of the right and left systems and the cabin pressure lowered. The Aircraft declared the emergency to the Air Traffic Control Center and after making the emergency descent until the Aircraft reached 10,000 ft, the Aircraft landed Niigata Airport, which was not the destination.		
	Probable Causes	In this serious incident, it is highly probable that because the supply of the both of right and left bleed air had stopped almost at the same time, the abnormal depressurization in the Aircraft occurred. In the fact regarding that the supply of the both of right and left bleed air had stopped, it is probable that because the airflow for cooling would have been restricted due to malfunction on both right and left fan air valves, the bleed air was hot and the corresponding NAPRSOV's closed.		

<table>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA06FJ.pdf</td></tr>
<tr><td rowspan="4">17</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td>November 29, 2018</td><td>August 27, 2017
At about 5,300 ft over the area 28 km northeast of Otsu City, Shiga Prefecture</td><td>Takumi Enterprise Helicopter & Airplane Co., Ltd.</td><td>JA7981
Robinson R44</td></tr>
<tr><td>Summary</td><td colspan="3">The Aircraft made an emergency landing at the ground of a school in Fushimi Ward, Kyoto City, as the “LOW FUEL” warning light came on while flying at about 5,300 ft over the area 28 km northeast of Otsu City, Shiga Prefecture.
Only a pilot was on board. There were no injuries.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is highly probable that this serious incident occurred because the helicopter took off without carrying the sufficient onboard fuel, as reported in its flight plan, to reach the destination and the pilot did not continuously monitor the fuel gages during the flight, which resulted in an emergency landing due to insufficient quantity of remaining fuel.
It is also highly probable that the helicopter did not carry the onboard fuel as reported in the flight plan because the pilot did not fully confirm the quantity of fuel onboard at that time before its departure, even though he had consumed some onboard fuel during other flights up to this flight after refueling the helicopter.</td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/JA7981.pdf</td></tr>
<tr><td rowspan="4">18</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td>November 29, 2018</td><td>September 23, 2017
Osaka City, Osaka</td><td>KLM Royal Dutch Airline</td><td>PH-BQC
Boeing 777-200</td></tr>
<tr><td>Summary</td><td colspan="3">The Aircraft took off from Kansai International Airport for Amsterdam Schiphol International Airport on a scheduled Flight 868 of the Operator. A right aft wing-to-body fairing panel was dropped from the aircraft climbing while accelerating over Osaka city. The dropped fairing panel collided with a vehicle driving on a road in Kita-ku, Osaka City.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is certain that this serious incident occurred when the departed right aft wing-to-body fairing panel struck and damaged a moving vehicle, while the aircraft was climbing and passing over the city of Osaka after takeoff.
Regarding the departure of the Panel, it is highly probable that the Bracket that secured the Panel’s forward upper corner by holding it to the Aircraft’s side broke, a gap was occurred between the Panel’s forward upper corner and the fuselage, and the Panel departed due to the pressure of inflowing air and vibration.
 
Dropped panel</td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/eng-air_report/PHBQC.pdf
See “Feature 2: Summaries of major aircraft accident and serious incident investigation reports (case studies)”, page 42</td></tr>
<tr><td rowspan="5">19</td><td>Date of Publication</td><td>Date and location</td><td>Operator</td><td>Aircraft registration number and aircraft type</td></tr>
<tr><td rowspan="2">December 20, 2018</td><td rowspan="2">March 18, 2018
Runway 18 at Naha Airport</td><td>Juneyao Airlines Co., Ltd.
(Aircraft A)</td><td>B8236
Airbus A320-214</td></tr>
<tr><td>Japan Coast Guard
(Aircraft B)</td><td>JA8570
Dassault-Breguet Mystère Falcon 900</td></tr>
<tr><td>Summary</td><td colspan="3">The Aircraft A commenced a take-off roll and took off from Runway 18 at Naha Airport without receiving a take-off clearance before the Aircraft B, which had landed earlier, vacated Runway 18.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is highly probable that this serious incident occurred as follows: Without receiving a takeoff clearance from the Tower, the Aircraft A commenced a take-off roll on the runway where the</td></tr>
</table>

		Aircraft B, which had landed earlier, was still present on the runway; furthermore, although the Aircraft A had failed to hear the Tower's instructions to stop immediately, it continued take-off roll. As for the reason that the Aircraft A commenced a take-off roll without a take-off clearance from the Tower, it is somewhat likely that the PIC failed to make mutual confirmation of whether to receive the take-off clearance among the flight crew members and made a hasty judgment that they would have received it.
	Report	http://www.mlit.go.jp/jtsb/eng-air_report/B8236_JA8570.pdf

7 Actions taken in response to recommendations in 2018

Actions taken in response to recommendations were reported with regard to three aircraft accidents and one aircraft serious incident in 2018. Summaries of these reports are as follows.

(1) Aircraft accident involving a privately owned Piper PA-46-350P (small aeroplane), registered JA4060

(Safety recommendations on July 18, 2017)

In view of the result of the investigation of aircraft accident that occurred at Chofu City, Tokyo on July 26, 2015, the Japan Transport Safety Board published an investigation report and recommended to the Minister of Land, Infrastructure, Transport and Tourism on July 18, 2017. The JTSB received the following notice concerning safety actions taken in response to the recommendations.

○Summary of the Accident

On Sunday, July 26, 2015, at around 10:58 Japan Standard Time (JST: UTC + 9 hrs: unless otherwise stated, all times are indicated in JST using the 24-hour clock), a privately owned Piper PA-46-350P, registered JA4060, crashed into a private house at Fujimi Town in Chofu City, right after its takeoff from Runway 17 of Chofu Airport. There were five people on board, consisting of a captain and four passengers. The captain and one passenger died and three passengers were seriously injured. In addition, one resident died and two residents had minor injuries.

The aircraft was destroyed and a fire broke out. The house where the aircraft had crashed into were consumed in a fire and neighboring houses sustained damage due to the fire and other factors.

○Probable causes

It is highly probable that this accident occurred as the speed of the aircraft decreased during takeoff and climb, which led the aircraft to stall and crash into a residential area near Chofu Airport.

It is highly probable that decreased speed was caused by the weight of the aircraft exceeding the maximum takeoff weight, takeoff at low speed, and continued excessive nose-up attitude.

As for the fact that the captain made the flight with the weight of the aircraft exceeding the maximum takeoff weight, it is not possible to determine whether or not the captain was aware that the weight of the aircraft exceeded the maximum takeoff weight prior to the flight of the accident because the captain is dead. However, it is somewhat likely that the captain had insufficient understanding of the risks of making the flight under such a situation and had insufficient safety awareness of observing relevant laws and regulations.

It is somewhat likely that taking off at low speed occurred because the captain decided to take a procedure to take off at such a speed; or because the Captain reactedand took off due to the approach of the Aircraft to the runway threshold.

It is somewhat likely that excessive nose-up attitude was continued in the state that nose-up tended to occur because the position of the C.G. of the Aircraft was close to the aft limit, the Captain maintained the nose-up attitude as he prioritized climbing over speed.

Adding to these factors, exceeding maximum takeoff weight, takeoff at low speed and continued excessive nose-up attitude, as the result of analysis using mathematical models, it is somewhat likely that the decreased speed was caused by the decreased engine power of the Aircraft; however, as there was no evidence of showing the engine malfunction, it was not possible to determine this.

○Recommendations to the Minister of Land, Infrastructure, Transport and Tourism

In this accident, small private aircraft crashed into a residential area and caused injury to residents as well as damages to houses, however the Aircraft was flying with exceeding the maximum takeoff weight and without satisfying the requirements for performance prescribed in the flight manual, and over the past five years, there have been two fatal accidents involving small private aircraft affected by inappropriate weight and position of the center of gravity of the aircraft ((i) Mooney M20C, JA3788, which crashed when landing at Yao Airport in March 2016, and (ii) Cessna 172N Ram, JA3814, which veered off the runway of Otone Airfield, Kawachi Town, Inashiki-gun, Ibaraki Prefecture, and made a fatal contact with a ground worker in August 2012). In view of the result of these accident investigations, as operation safety of small private aircraft needs to be improved, the Japan Transport Safety Board recommends the Minister of Land, Infrastructure Transport and Tourism pursuant to Article 26 of the Act for Establishment of the Japan Transport Safety Board to take the following measures:

(1) Promote pilots of small private aircraft to understand the importance to confirm that requirements for performance prescribed in the flight manual are satisfied, in addition to the importance to comply with maximum takeoff weight and limit for the position of the center of gravity, as confirmation before departure, at the occasions like specific pilot competency assessments and aviation safety seminars.

Enforce instructions and trainings to pilots of small private aircraft to plan the actions in advance including to follow the emergency procedure prescribed in the flight manual and confirm these actions thorough self-briefing by a pilot himself at the time of preparation before departure. along with compliance with the speed and procedure prescribed in the flight manual, as for the actions to the situation of degraded flight performance due to lack of acceleration or decrease in speed during takeoff.

(2) Study and compile the cases of effective measures connecting entrance taxiways to runway thresholds in order to make maximum use of runway length and inform aerodrome providers and administrators of these case studies as maximum use of runway length at takeoff, will allow

a pilot to have a margin to make a decision during takeoff roll and contribute to improving safety.

○Safety Actions taken in response to the recommendations

To improve the safety of small private aircraft, we have been conducting initiatives to prevent recurrence by such as distributing safety awareness leaflets, holding aviation safety courses, and issuing warning documents that include re-inspection of checking procedures performed prior to departure for such as takeoff weight immediately following an accident. Additionally, the following action was newly performed based on the recommendations.

1. (i) We issued Japan Air Navigation No.1261 and Japan Aircraft No.1155 "Maintaining safety for small aircraft services" dated July 18, 2017 for small private plane service operators and relevant organizations. This was to remind them to work towards maintaining safety more than ever and disseminate this information to their affiliated members and other parties to ensure that the maximum weight based on the aircraft's performance is checked before flying and that also checks are always performed so that pilots know how to deal with situations such as re-landing when the aircraft's performance drops during takeoff.

(ii) With the cooperation of relevant organizations and the committee, we newly created leaflets about preparing for emergencies and complying with the flight manual in addition to reliably implementing check prior to departure for such as takeoff weight. We also revised oral guidance and detailed rules for implementation of the specific pilot skill review, and decided to review this information with a focus on the content of the leaflet.

We requested pilot skill examiners to ask the people being examined if they understood the content of the leaflet prior to the specific pilot skill review and also hand over the leaflet to the people being examined during the briefing after the review is complete or similar such time. We also requested the examiners make their review with a focus on the revised detailed rules of implementation and oral guidance.

In addition, we also requested regional civil aviation bureaus to use the opportunity of regular training and certifying pilot skill examiners as conducted by the bureaus to disseminate the information contained in the above request to their examiners, and to also distribute the leaflet to pilots at every opportunity even at airport offices and such locations under the control of the regional civil aviation bureaus.

Additionally, we issued Japan Air Navigation No.1548 and Japan Aircraft No.1557 "Revision of safety maintenance for small aircraft services and specific pilot skill review detailed rules of implementation" for small aircraft service operators and relevant organizations. We also requested that these operators reliably disseminate the content of the leaflet to affiliated members and such as well as promote understanding of the content, while at the same time we requested the operators to disseminate information concerning the reliable implementation of the specific pilot skill review based on the revised detailed rules of implementation and oral guidance to affiliated pilot skill examiners.

In addition, in view of small aircraft accidents being prominent in the media in recent years, this matter was implemented based on opinions received from experts and relevant organizations, etc., at the 3rd committee meeting (held on September 25, 2017) of "The Safety Promotion Committee Concerning Small Aircraft" established on December 2016.

(iii) At the "Safe Flight Seminar" held at all major airports nationwide from October 17 to November 10, 2017, we distributed leaflets once again and also promoted understanding of responses relating to the content of the recommendations, which included the safety

measures used at aviation bureaus so far. We also explained about the detailed rules of implementation and oral guidance relating to the revised specific pilot skill review together with the content of the leaflet.

(iv) We have made the leaflet created in response to the recommendations, and the revised detailed rules of implementation and oral guidance available on the MLIT website, and further promoted safety awareness.

2. We collected case examples of fully using the length of existing runways during aircraft takeoff based on the layout of turning pads and attached taxiways, and issued and disseminated information contained in the "Case examples of fully using airport takeoff runway length" report Japan Aircraft Safety Planning No.92 dated July 18, 2017 to the airport facilities and management.

Documents relating to the above information are attached.

*The original text of the notification from the Minister of Land, Infrastructure, Transport and Tourism can be found on the JTSB website.
http://www.mlit.go.jp/jtsb/airkankoku/kankoku10re_300123.pdf

8 Provision of factual information in 2018 (aircraft accidents and serious incidents)

The JTSB provided factual information for 2 cases in 2018. The content is as follows.

(1) Aircraft serious incident involving an Airbus A320-214, registered JA805P, operated by Peach Aviation

(Information provided on March 30, 2018)

The Japan Transport Safety Board provided the following information on the serious incident that occurred on March 3, 2018, to Civil Aviation Bureau, the Ministry of Land, Infrastructure, Transport and Tourism.

(Summary of the serious incident)

JA805P (Airbus A320-214) belonging to Peach Aviation landed at Fukuoka Airport around 8:11 AM on March 24, 2018 and then stopped on the runway because its nose landing gear tires misaligned to face sideways.

(Content of investigation)

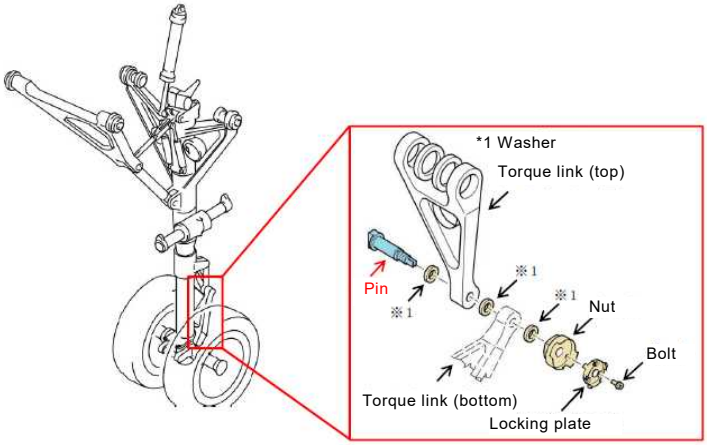
The following facts were identified as a result of the investigation to date.

- The pin connecting the top and bottom torque links on the nose landing gear fell off and was found on the runway.

- The nut, locking plate, washer and bolt fastened onto the landing gear along with this pin has not been found at Fukuoka Airport or Kansai International Airport, where the aircraft departed.
- The state of the pin that fell off the landing gear is as shown in the attachment. (See attachment)

(Attachment)

Photo of pin



Drawing of nose landing gear

* The information provided can be found on the JTSB website.
http://www.mlit.go.jp/jtsb/iken-teikyo/JA805P20180324.pdf

(2) Aircraft serious incident involving Boeing 777-300, registered HL7573, operated by Korean Air

(Information provided on July 24, 2018)

The Japan Transport Safety Board provided the following information on the serious incident that occurred on June 29, 2018, to Civil Aviation Bureau, the Ministry of Land, Infrastructure, Transport and Tourism.

(Summary of the serious incident)

Boeing 777-300, registered HL7573, operated by Korean Air, landed at Narita International Airport at 12:37 PM on June 29 (Friday) as the regular KAL703 flight from Korean Air. While traveling along the ground, the aircraft's main right landing gear was damaged causing it to stop on the taxiway.

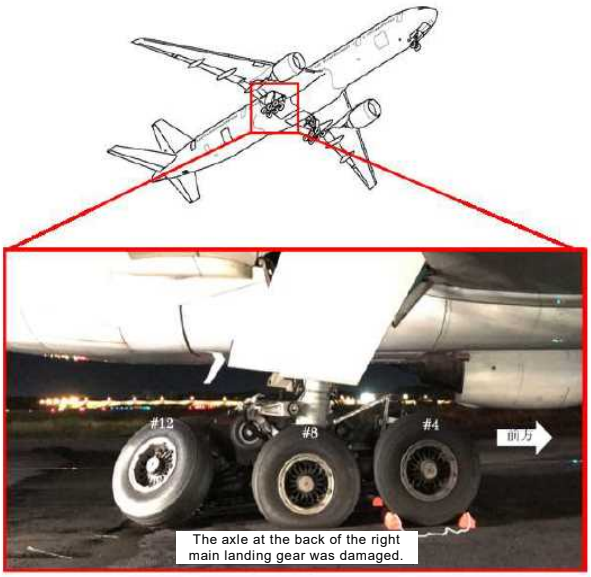
(Content of investigation)

The following facts were identified as a result of the investigation to date. (See attachment)

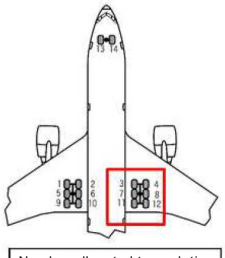
- The axle on the main right landing gear was broken.
- Part of the fractured surface on the damaged section was discolored black.
- The axle had been installed as a replacement on the main right landing gear in July 2009.

A detailed investigation is scheduled in the near future concerning the reason the axle broke, etc.

(Attachment (excerpt))



The axle at the back of the right main landing gear was damaged.


Number allocated to each tire

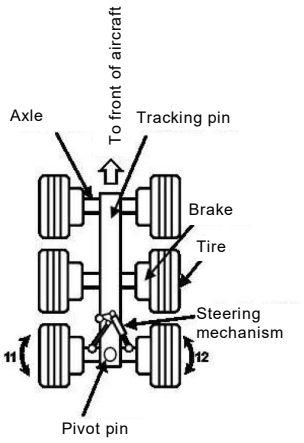


Photo when looking from the rear of the plane at the right main landing gear

* The information provided can be found on the JTSB website.
http://www.mlit.go.jp/jtsb/iken-teikyo/HL757320180629.pdf

Column

Acquiring data recorded on damaged electronic devices

Aviation Accident Investigator

In recent years, many electronic devices (GPS receivers, smartphones, tablet computers, etc.) are carried onto aircraft, and now record various data in the form of GPS data, photos and video.

During aviation accident investigations, data recorded on these type of electronic devices is retrieved for analysis purposes to check the flight status such as the flight path of the aircraft involved in the accident and whether the aircraft experienced a failure. However, many electronic devices carried on board the aircraft are damaged during the accident making it impossible to acquire data with a data retrieval method that connects a standard cable to the damaged electronic device. Therefore, the memory chip mounted on the internal circuit board is removed and the data is retrieved directly using dedicated equipment.

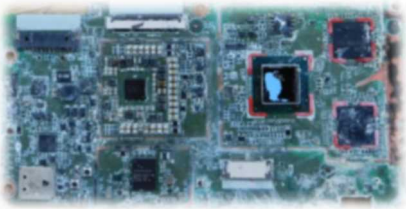
Damaged electronic device

Data is retrieved from a damaged electronic device using the following procedure.

Verify state of device → Clean → Dismantle → Remove memory chip → Retrieve data

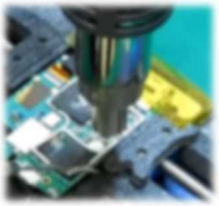
Damaged electronic devices are most often damaged due to factors such as damage due to impact, water penetrating inside the device, heat damage due to fire, and contamination due to fire extinguishing agents so it is necessary to check the state of damage, contamination and other such factors before cleaning them.

After this, the device's case is removed, the circuit board removed, and then the memory chip that stored the data is removed. The memory chip is removed using a soldering iron, heat gun or rework equipment depending on the type of memory chip.



Contaminated circuit board

Cleaning



Removing the memory chip

Retrieving data

Recorded data is retrieved from the removed memory chip using dedicated equipment. Data recorded on a memory chip usually disappears after several years under normal conditions. Data on a contaminated memory chip usually disappears after several days or months. Therefore, it is necessary to quickly retrieve this data. Data retrieved using dedicated equipment is retrieved in binary format as an image of the recorded region. This binary data is converted using dedicated software to a format that can be used with standard software.

Data in binary format

Many modern electronic devices encrypt data when it is stored on the memory chip, and the data may not be converted correctly in this case.

One of the action guidelines of the Japan Transport Safety Board mention the implementation of scientific and objective accident investigations. The JTSB is collecting information and maintaining equipment on a daily basis and also improving investigation techniques, while also compiling factual information to analyze the cause of accidents so that we can support the latest technology, in addition to existing methods, to respond to technology that is evolving every day.

Chapter 4 Railway accident and serious incident investigations

1 Railway accidents and serious incidents to be investigated

< Railway accidents to be investigated >

◎Paragraph 3, Article 2 of the Act for Establishment of the Japan Transport Safety Board

(Definition of railway accident)

The term "Railway Accident" as used in this Act shall mean a serious accident prescribed by the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism among those of the following kinds of accidents; an accident that occurs during the operation of trains or vehicles as provided in Article 19 of the Railway Business Act, collision or fire involving trains or any other accidents that occur during the operation of trains or vehicles on a dedicated railway, collision or fire involving vehicles or any other accidents that occur during the operation of vehicles on a tramway.

◎Article 1 of Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (Serious accidents prescribed by the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism, stipulated in paragraph 3, Article 2 of the Act for Establishment of the Japan Transport Safety Board)

1 The accidents specified in items 1 to 3 inclusive of paragraph 1 of Article 3 of the Ordinance on Report on Railway Accidents, etc. (the Ordinance) (except for accidents that involve working snowplows that specified in item 2 of the above paragraph);

2 From among the accidents specified in items 4 to 6 inclusive of paragraph 1 of Article 3 of the Ordinance, that which falls under any of the following sub-items:

(a) an accident involving any passenger, crew, etc. killed;

(b) an accident involving five or more persons killed or injured;

(c) a fatal accident that occurred at a level crossing with no automatic barrier machine;

(d) an accident found to be likely to have been caused owing to a railway officer's error in handling or owing to malfunction, damage, destruction, etc. of the vehicles or railway facilities, which resulted in the death of any person;

3 The accidents specified in items 4 to 7 inclusive of paragraph 1, Article 3 of the Ordinance which are found to be particularly rare and exceptional;

4 The accidents equivalent to those specified in items 1 to 7 inclusive of paragraph 1, Article 3 of the Ordinance which have occurred relevant to dedicated railways and which are found to be particularly rare and exceptional; and

5 The accidents equivalent to those specified in items 1 to 3 inclusive which have occurred relevant to a tramway, as specified by a public notice issued by the Japan Transport Safety Board.

[Reference] The accidents listed in each of the items of paragraph 1, Article 3 of the Ordinance on Reporting on Railway Accidents, etc.

Item 1: Train collision
Item 2: Train derailment
Item 3: Train fire
Item 4: Level crossing accident
Item 5: Accident against road traffic
Item 6: Other accidents with casualties
Item 7: Heavy property loss without casualties

◎**Article 1 of the Public Notice of the Japan Transport Safety Board** (Accidents specified by the public notice stipulated in item 5, Article 1 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board)

1 From among the accidents specified in items 1 to 6 inclusive of paragraph 1 of Article 1 of the Ordinance on Reporting on Tramway Accidents, etc. (the Ordinance), that which falls under any of the following sub-items:

(a) an accident that causes the death of a passenger, crewmember, etc.;
(b) an accident involving five or more casualties (with at least one of the casualties dead);
(c) a fatal accident that occurs at a level crossing with no automatic barrier machine;

2 The accidents specified in items 1 to 7 inclusive of paragraph 1 Article 1 of the Ordinance which are found to be particularly rare and exceptional; and

3 From among the accidents occurring on a tramway operated under the application of the Ministerial Ordinances to provide Technical Regulatory Standards on Railways mutatis mutandis as specified in paragraph 1 of Article 3 of the Ordinance on Tramway Operations, the accidents equivalent to those specified in items 1 to 3 of Article 1 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

[Reference] The accidents specified in the items of paragraph 1, Article 1 of the Ordinance on Reporting on Tramway Accidents, etc.

Item 1: Vehicle collision
Item 2: Vehicle derailment
Item 3: Vehicle fire
Item 4: Level crossing accident
Item 5: Accidents against road traffic
Item 6: Other accidents with casualties
Item 7: Heavy property loss without casualties

Railway accidents to be investigated

<table>
<tr><th>Category</th><th>Train collision*2)</th><th>Train derailment*2)</th><th>Train fire*2)</th><th>Level crossing accident</th><th>Accident against road traffic</th><th>Other accidents with casualties</th><th>Heavy property loss without casualties</th></tr>
<tr><td rowspan="2">Railway (including tramway operated as equivalent to railway) [Notice 1-3]</td><td colspan="4" rowspan="2">All accidents*1) [Ordinance 1-1]</td><td colspan="3">・Accidents involving the death of a passenger, crew member, etc.
・Accidents involving five or more casualties with at least one of the casualties dead
・Fatal accidents that occur at level crossings with no automatic barrier machines
・Accidents found to have likely been caused by a railway worker's error in procedure or due to the malfunction, damage, destruction, etc., of vehicles or railway facilities, which resulted in the death of a person [Ordinance 1-2]</td><td></td></tr>
<tr><td colspan="4">Accidents that are particularly rare and exceptional [Ordinance 1-3]</td></tr>
<tr><td>Dedicated railway</td><td colspan="8">Accidents that are particularly rare and exceptional [Ordinance 1-4]</td></tr>
<tr><td rowspan="2">Tramway [Ordinance 1-5]</td><td colspan="7">・Accidents involving the death of a passenger, crewmember, etc.
・Accidents involving five or more casualties with at least one of the casualties dead
・Fatal accidents that occur at level crossings with no automatic barrier machines. [Notice 1-1]</td><td></td></tr>
<tr><td colspan="8">Accidents that are particularly rare and exceptional [Notice 1-2]</td></tr>
</table>

*1 Except for derailment accidents of working snowplows. [Ordinance 1-1]
However, accidents that are particularly rare and exceptional are to be investigated. [Ordinance 1-3]

*2 If these categories occur on a tramway, the accident types shall each be renamed to “vehicle collision”, “vehicle derailment”, or “vehicle fire”.

(Note) “Ordinance” refers to the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board; “Notice” refers to the Public Notice by the Japan Transport Safety Board; and the numbers refer to the Article and paragraph numbers.

< Railway serious incidents to be investigated >

◎Item 2, paragraph 4, Article 2 of the Act for Establishment of the Japan Transport Safety Board (Definition of railway serious incident)

A situation, prescribed by the Ordinance of the Ministry of Land, Infrastructure, Transport and Tourism (Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board), deemed to bear a risk of accident occurrence.

◎Article 2 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (A situation prescribed by the Ordinance of the Ministry of Land, Infrastructure, Transport and Tourism, stipulated in item 2, paragraph 4, Article 2 of the Act for Establishment of the Japan Transport Safety Board)

1 The situation specified in item 1 of paragraph 1 of Article 4 of the Ordinance on Reporting on Railway Accidents, etc. (the Ordinance), wherein another train or vehicle had existed in the zone specified in said item;

[A situation where a train starts moving for the purpose of operating in the relevant block section before completion of the block procedure: Referred to as “Incorrect management of safety block.”]

2 The situation specified in item 2 of paragraph 1 of Article 4 of the Ordinance, wherein a train had entered into the route as specified in said item;

[A situation where a signal indicates that a train should proceed even though there is an obstacle in the route of the train, or the route of the train is obstructed while the signal indicates that the train should proceed: Referred to as “Incorrect indication of signal.”]

3 The situation specified in item 3 of paragraph 1 of Article 4 of the Ordinance, wherein another train or vehicle had entered into the protected area of the signal which protects the zone of the route as specified in said item;

[A situation where a train proceeds regardless of a stop signal, thereby obstructing the route of another train or vehicle: Referred to as “Violating red signal.”]

4 The situation specified in item 7 of paragraph 1 of Article 4 of the Ordinance, which caused malfunction, damage, destruction, etc. bearing particularly serious risk of collision or derailment of or fire in a train;

[A situation that causes a malfunction, etc., of facilities: Referred to as “Dangerous damage in facilities.”]

5 The situation specified in item 8 of paragraph 1 of Article 4 the Ordinance, which caused malfunction, damage, destruction, etc. bearing particularly serious risk of collision or derailment of or fire in a train;

[A situation that causes a malfunction, etc., of a vehicle: Referred to as “Dangerous trouble in vehicle.”]

6 The situation specified in items 1 to 10 inclusive of paragraph 1 of Article 4 of the Ordinance which is found to be particularly rare and exceptional; and

[These are referred to as: item 4 “Main track overrun”; item 5 “Violating closure section for

construction"; item 6 "vehicle derailment"; item 9 "Heavy leakage of dangerous object"; and item 10 "others," respectively.]

7 The situations occurred relevant to the tramway as specified by a public notice of the Japan Transport Safety Board as being equivalent to the situations specified in the preceding items.

○**Article 2 of the Public Notice of the Japan Transport Safety Board** (A situation prescribed by the public notice stipulated in item 7, Article 2 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (Serious incident on a tramway))

1 The situation specified in item 1 of Article 2 of the Ordinance on Reporting on Tramway Accidents, etc. (the Ordinance), wherein another vehicle operating on the main track had existed in the zone specified in said item;

[A situation where a vehicle is operating on the main track for the purpose of operating in the relevant safety zone before the completion of safety system procedures: Referred to as "Incorrect management of safety block."]

2 The situation specified in item 4 of Article 2 of the Ordinance, which caused malfunction, damage, destruction, etc., bearing a particularly serious risk of collision, derailment of or fire in a vehicle operating on the main track;

[A situation that causes a malfunction, etc., of facilities: Referred to as "Dangerous damage in facilities."]

3 The situation specified in item 5 of Article 2 of the Ordinance, which caused malfunction, damage, destruction, etc., bearing a particularly serious risk of collision, derailment or fire in a vehicle operating on the main track;

[A situation that causes a malfunction, etc., of a vehicle: Referred to as "Dangerous trouble in vehicle."]

4 The situation specified in items 1 to 7 inclusive of Article 2 of the Ordinance which is found to be particularly rare and exceptional; and

[These are referred to as: item 2 "Violating red signal;" item 3 "Main track overrun;" item 6 "Heavy leakage of dangerous object;" and item 7 "others," respectively.]

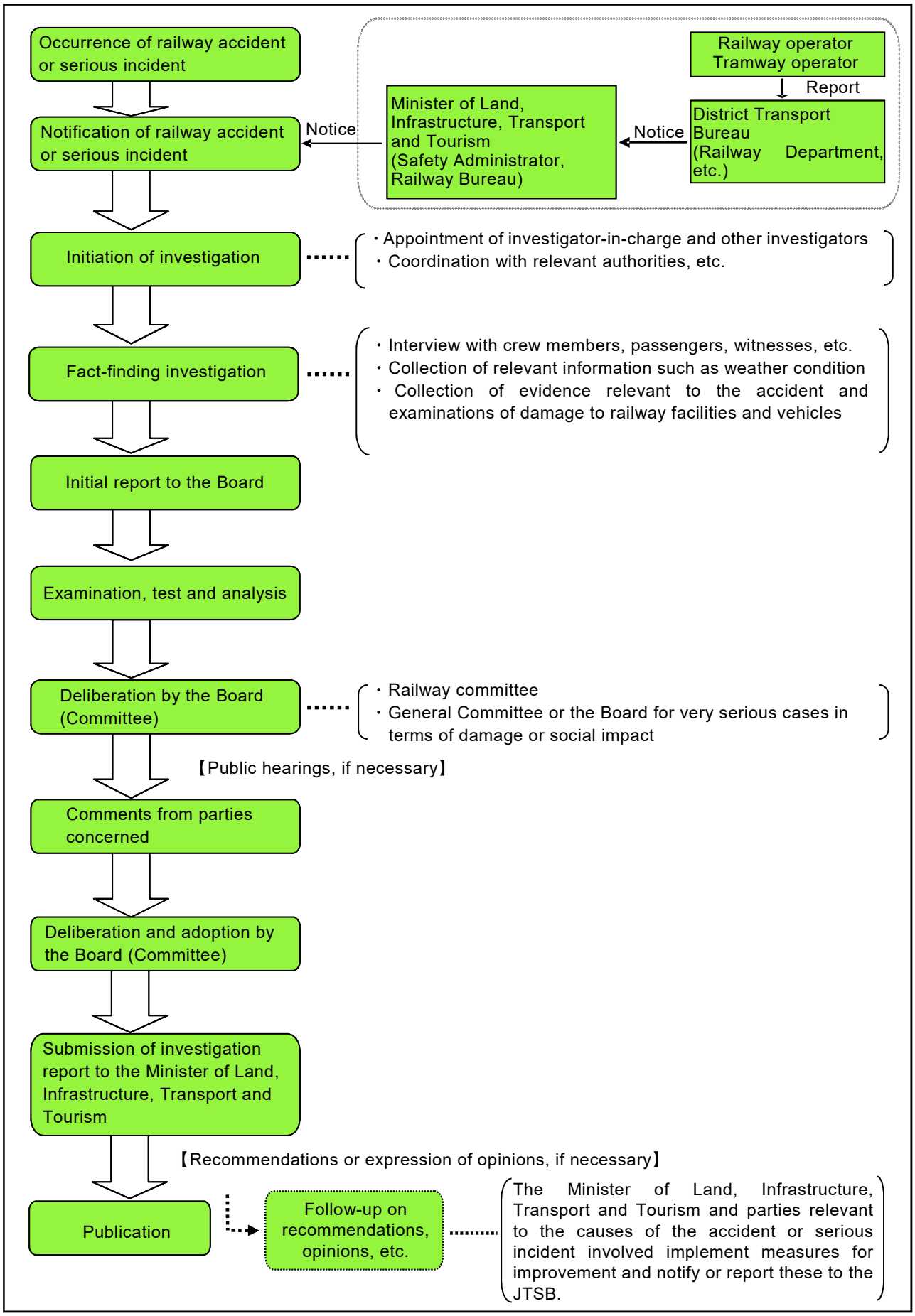
5 From among the situations occurring on a tramway operated under the application of the Ministerial Ordinances to provide Technical Regulatory Standards on Railways mutatis mutandis as specified in paragraph 1 of Article 3 of the Ordinance on Tramway Operations, the situations equivalent to those specified in items 1 to 6 of Article 2 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

Serious incidents to be investigated

<table>
<tr><td>Category</td><td>・Incorrect management of safety block</td><td>・Incorrect indication of signal
・Violating red signal</td><td>・Dangerous damage in facilities</td><td>・Dangerous trouble in vehicle</td><td>・Main track overrun
・Violating closure section for construction
・Vehicle derailment
・Heavy leakage of dangerous object
・Others</td></tr>
<tr><td rowspan="2">Railway
(including tramway operated as equivalent to railway)
[Notice 2-5]</td><td colspan="2">Certain conditions such as the presence of another train
[Ordinances 2-1, 2-2, and 2-3]</td><td colspan="2">Risk of collision, derailment or fire
[Ordinances 2-4 and 2-5]</td><td></td></tr>
<tr><td colspan="5">Incidents that are particularly rare and exceptional [Ordinance 2-6]</td></tr>
<tr><td></td><td>・Incorrect management of safety block</td><td>・Violating red signal</td><td>・Dangerous damage in facilities</td><td>・Dangerous trouble in vehicle</td><td>・Main track overrun
・Heavy leakage of dangerous object
・Others</td></tr>
<tr><td rowspan="2">Tramway
[Ordinance 2-7]</td><td>Certain conditions such as the presence of a vehicle
[Notice 2-1]</td><td></td><td colspan="2">Risk of collision, derailment or fire
[Notices 2-2 and 2-3]</td><td></td></tr>
<tr><td colspan="5">Incidents that are particularly rare and exceptional [Notice 2-4]</td></tr>
</table>

(Note) "Ordinance" refers to the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board; "Notice" refers to the Public Notice by the Japan Transport Safety Board; and the numbers refer to the Article and paragraph numbers.

2 Procedure of railway accident/incident investigation



3 Statistics of investigations of railway accidents and serious incidents

The JTSB carried out investigations of railway accidents and serious incidents in 2018 as follows:

15 accident investigations had been carried over from 2017, and 11 accident investigations were newly launched in 2018. 15 investigation reports were published in 2018, and thereby 11 accident investigations were carried over to 2019.

One serious incident investigation had been carried over from 2017, and two serious incident investigations were newly launched in 2018. No investigation reports was published in 2018, and thereby three serious incident investigations were carried over to 2019.

Investigations of railway accidents and serious incidents in 2018

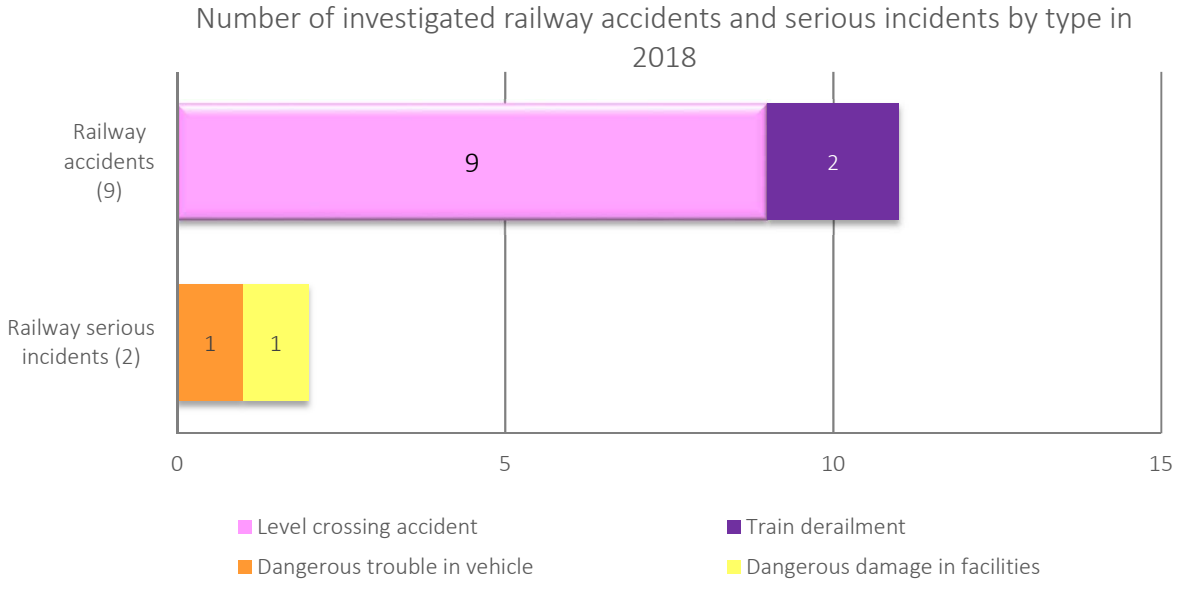
(Cases)

Category	Carried over from 2017	Launched in 2018	Total	Published investigation reports	(Recommendations)	(Opinions)	Carried over to 2019	(Interim report)
Railway accident	15	11	26	15	(0)	(1)	11	(0)
Railway serious incident	1	2	3	0	(0)	(1)	3	(1)

4 Statistics of investigations launched in 2018

The railway accidents and serious incidents that were newly investigated in 2018 consisted of 11 railway accidents, down by eight from 19 for the previous year, and two railway serious incidents, up by one from one for the previous year.

The breakdown by type of accidents and serious incidents is as follows: The railway accidents included nine level crossing accidents and two train derailments. The railway serious incidents included one vehicle damage and one facility damage.



In the 11 railway accidents, the number of casualties was nine, consisting of nine death and no injured person.

The number of casualties (in railway accidents)

(Persons)

2018							
Category	Dead			Injured			Total
	Crew	Passenger	Others	Crew	Passenger	Others	
Casualties	0	0	9	0	0	0	9
Total	9			0			

*The above statistics include incidents under investigation so may change depending on the status of the investigation and deliberation.

5 Summaries of railway accidents and serious incidents which occurred in 2018

The railway accidents and railway serious incidents which occurred in 2018 are summarized as follows. The summaries are based on information available at the start of the investigations and therefore are subject to change depending on the course of investigations and deliberations.

(Railway accidents)

1	Date and accident type	Railway operator	Line section (location)
	January 16, 2018 Level crossing accident	Central Japan Railway Company	Bozuyama level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Idagawa station and Kasado station, Kansai Line, Mie Prefecture
	Summary	See “6 Publication of investigation reports” (Page 147, No.13)	
2	Date and accident type	Railway operator	Line section (location)
	February 24, 2018 Train derailment	Japan Freight Railway Company	On the premises of Tomamu Station, Sekisho Line (Hokkaido)
	Summary	While a railway maintenance officer was checking the site where a point machine at Tomamu Station did not operate, the officer discovered signs that a train had temporarily derailed. When the train that had passed the location was checked, it was verified that the wheels on the 1st axle of the 3rd vehicle of the train were damaged.	
3	Date and accident type	Railway operator	Line section (location)
	February 27, 2018 Level crossing accident	East Japan Railway Company	Renkouji level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Tateyama Station and Kokonoe Station, Uchibo Line, Chiba Prefecture
	Summary	The train driver used the emergency brake on discovering a pedestrian entering Renkouji level crossing, class 4 level crossing, while the train was traveling at a speed of 77 km/h between Tateyama Station and Kokonoe Station. However, the train hit the pedestrian. The pedestrian died in the accident.	
4	Date and accident type	Railway operator	Line section (location)
	April 11, 2018 Level crossing accident	Shikoku Railway Company	Takabayashi level crossing, class 3 level crossing equipped with road warning device but without automatic barrier machine, between Iyo-Sakurai Station and Iyo-Miyoshi Station, Yosan Line, Ehime Prefecture

	Summary	See “6 Publication of investigation reports” (Page 148, No.14)	
5	Date and accident type	Railway operator	Line section (location)
	June 16, 2018 Level crossing accident	Kyushu Railway Company	Oho level crossing, class 4 level crossing without automatic barrier machine nor road warning device, on the premises of Kubota Station, Nagasaki Line, Saga Prefecture
	Summary	The train driver used the emergency brake and sounded a whistle on discovering a vehicle entering Oho level crossing, class 4 level crossing, while the train was traveling at a speed of 84 km/h between Nabeshima Station and Kubota Station. However, the train hit the vehicle. The driver of the vehicle died in the accident.	
6	Date and accident type	Railway operator	Line section (location)
	June 16, 2018 Train derailment	Keiyorinkai Co., Ltd.	On the premises of Soga Station, Rinkai Main Line, Chiba Prefecture
	Summary	The train driver felt the train dragging from the rear after departing from Soga Station and checked the rear of the train. While doing so, he discovered that the freight wagon was shaking so stopped the train. While checking the situation after this, the 4th freight wagon from the front of the train had derailed to the left side in the direction of travel.	
7	Date and accident type	Railway operator	Line section (location)
	July 30, 2018 Level crossing accident	East Japan Railway Company	Daisan Ota level crossing, class 4 level crossing withouut automatic barrier machine nor road warning device, between Ashikaga Station and Yamamae Station, Ryomo Line, Tochigi Prefecture
	Summary	The train driver sounded a whistle and then immediately used the emergency brake on discovering a pedestrian pushing a bicycle over the Daisan Ota level crossing,(class 4 level crossing), while the train was traveling at an approximate speed of 83 km/h between Ashikaga Station and Yamamae Station. However, the train hit the pedestrian. The pedestrian die in the accident.	
8	Date and accident type	Railway operator	Line section (location)
	September 27, 2018 Level crossing accident	West Japan Railway Company	Iwasakinoichi level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Michinoue Station and Managura Station, Fukuen Line, Hiroshima Prefecture
	Summary	The train driver resorted to emergency braking action on discovering a person entering the level crossing from the left side of the direction of travel but the train hit the person. The rider of the bicycle involved in the accident was later confirmed to be dead.	
9	Date and accident type	Railway operator	Line section (location)
	October 3, 2018 Level crossing accident	Central Japan Railway Company	Miyamae level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Motozenkoji Station and Ina-Kamisato Station, Iida Line, Nagano Prefecture
	Summary	The train driver used the emergency brake and continued to sound a whistle on discovering a pedestrian entering Miyamae level crossing, class 4 level crossing, while the train was traveling at an approximate speed of 53 km/h between Motozenkoji Station and Ina-Kamisato Station. However, the train hit the pedestrian. The pedestrian died in the accident.	
10	Date and accident type	Railway operator	Line section (location)
	December 12, 2018 Level crossing accident	Shikoku Railway Company	Nakatsuchi level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Iyo-Tomita Station and Iyo-Sakurai Station, Yosan Line, Ehime Prefecture

	Summary	The train driver sounded a whistle and resorted to emergency brake action on discovering a motorized bicycle entering the level crossing from the left side of the direction of travel but the train hit the motoried bicycle. The rider of the motorized bicycle involved in the accident was later confirmed to be dead.

11	Date and accident type	Railway operator	Line section (location)
	December 19, 2018 Level crossing accident	Chichibu Railway Co., Ltd.	Hanyu No.22 level crossing, class 4 level crossing without automatic barrier machine nor road warning device, on the premises of Shingo Station, Chichibu Main Line, Saitama Prefecture
	Summary	The train driver resorted to emergency brake action on discovering a pedestrian entering the level crossing from the right side of the direction of travel but the train hit the person. The pedestrian involved in the accident was later confirmed to be dead.	

(Railway serious incidents)

1	Date and incident type	Railway operator	Line section (location)
	May 15, 2018 Dangerous trouble in vehicle	Nishi-Nippon Railroad Co., Ltd.	Between Kasugabaru Station and Zasshonokuma Station, Tenjin Omuta Line, Fukuoka Prefecture
	Summary	Immediately after the train departed from Kasugabaru Station, a commuter on the platform informed the conductor that the door was open. After this, the conductor patrolled around inside the train to check the situation and confirmed that the last left side door on the 3rd vehicle from the front of the direction of travel was open.	

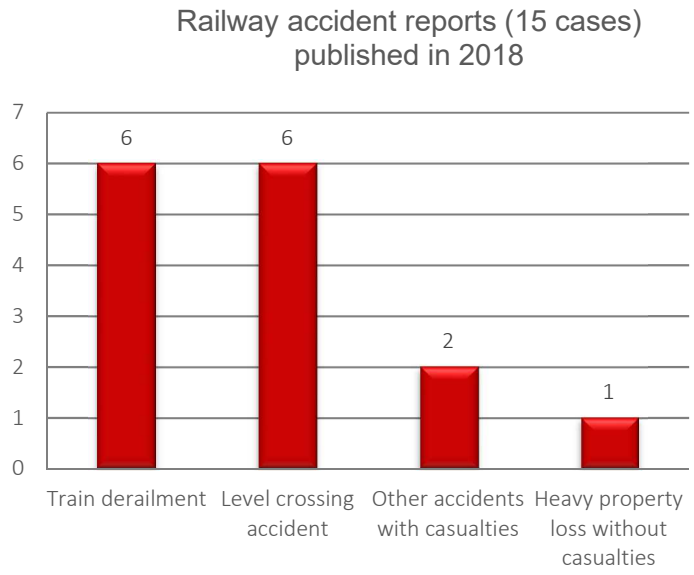
2	Date and incident type	Railway operator	Line section (location)
	November 9, 2018 Dangerous damage in facilities	Hokkaido Railway Company	On the premises of Shin-Sapporo Station, Chitose Line, Hokkaido Close to 8,509 meters from the starting point of Naebo Station
	Summary	The train driver discovered an obstacle extending across the track from the outbound line to the inbound line in front of the train while the train was traveling. He applied the brakes and stopped the train 15 meters in front of the obstacle, and then used the protective radio to signal an alarm. When checking the obstacle, it was found that the 1st outbound departure signal had collapsed onto the tracks.	

6 Publication of investigation reports

The number of investigation reports of railway accidents and serious incidents published in 2018 was 15, consisting of 15 railway accidents and no serious incident.

Breaking them down by type, the railway accidents contained six train derailment accidents, six level crossing accidents, two other accidents with casualties, and one heavy property loss without casualties. There were no railway serious incidents.

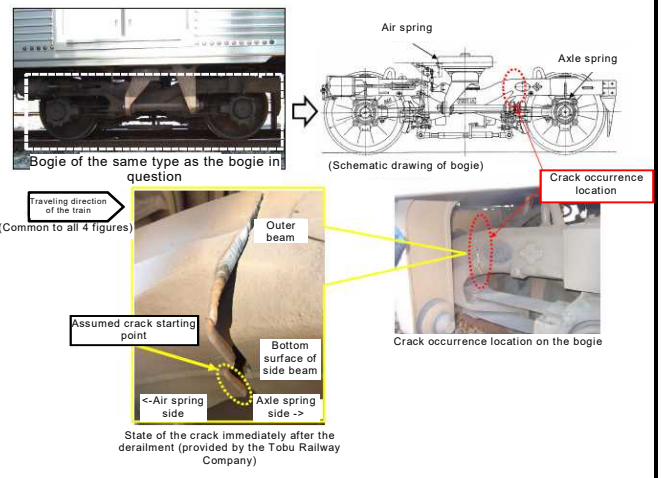
In the 15 accidents, the number of casualties was 12, consisting of nine death and three injured persons.



The investigation reports of railway accidents and serious incidents published in 2018 are summarized as follows.

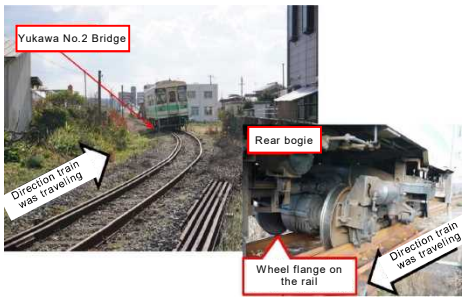
Railway accident and serious incident reports published in 2018

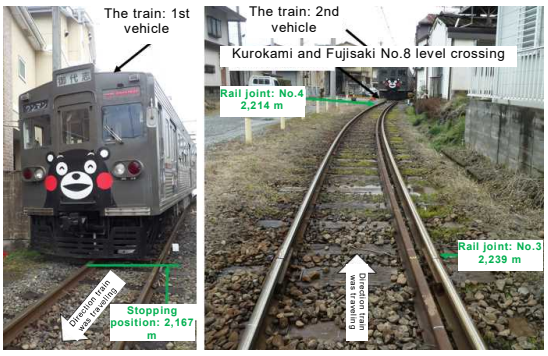
1	Date of Publication	Date and accident type	Railway operator	Line section (location)
	January 25, 2018	May 18, 2016 Train derailment	Tobu Railway Company	In the premises of Naka-itabashi station, Tojo Main Line, Itabashi-ku, Tokyo
	Summary	The train departed from Naka-itabashi station on schedule. After the train had operated in powering operation, the driver of the train shifted the notch off at about 30 km/h to operate in coasting operation until the rearmost vehicle passed the No.12 turnout in the premises of Naka-itabashi station, where the speed limit was 35 km/h. When the train driver accelerated the train in powering operation again, after the train had passed the turnout, he noticed that the emergency button in the cabin was operated, then applied the emergency brake to stop the train. After that, the conductor checked the status of outside train and found that all two axles in the rear bogie of the 5th vehicle were derailed to right. There were about 400 passengers, the train driver and the conductor onboard the train, but no one was injured.			



	Probable Causes	It is probable that the right wheel of the front axle in the rear bogie in the 5th vehicle of the train climbed up the right rail and derailed to right, because the wheel load unbalance had been enlarged as the wheel load of the right wheel of the front axle had decreased due to the crack, existing from the bottom plate to upper part of the side surface of the side beam in right side of the rear bogie, and the lateral force of the right wheel of the front axle had increased when the rear bogie had entered the left curved track of 178 m radius, in the accident. It is probable that the wheel load of the right wheel of the front axle in the rear bogie had decreased because the wheel could not support the vertical load required to the wheel as the strength of the side beam had decreased due to the crack. It is somewhat likely that the existence of the welding defects, in the welded portion of the reinforcing plate at inside of the side beam, caused the generation of the crack in the side beam. However, it could not be determined the reason why the side beam was cracked because the precise evaluation by the observation of the broken surface could not be implemented due to the damages etc., of the broken surface of the crack.
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-1-p.pdf (Explanatory material) See “Feature 2: Summaries of major railway accident and serious incident investigation reports (case studies)”, page 43

2	Date of Publication	Date and accident type	Railway operator	Line section (location)
	January 25, 2018	January 22, 2017 Train derailment	Kishu Railway Company	Between Gobo station and Gakumon station, Kishu Railway Line, Gobo City, Wakayama Prefecture
	Summary	When the train proceeded about 500 m from Gobo station, the driver of the train noticed abnormal sounds several times from under floor, then applied the emergency brake and stopped the train. The driver got off the train to check the situation, and found that all axles in the rear bogie of the vehicle had been derailed to right. There were 5 passengers and the driver onboard the train, but no one was injured.		
	Probable Causes	It is probable that the left wheels of the 1st and 2nd axles in the rear bogie derailed to the inside of the gauge, i.e., right side of the left inner rail, because the gauge was widened largely while the train was passing through the 160 m radius left curved track, in the accident. As for the large gauge widening, it is somewhat likely that the gauge was widened dynamically by the rail tilting and deflection of rail due to the lateral force caused by the train running, because the rail fastening forces by the spikes had been deteriorated as there had been continuous decays and cracks in the sleepers in the left curved track. It is somewhat likely that the deterioration of the rail fastening forces, due to the existence of continuous decays and cracks in the sleepers, were related with that the company had not comprehended sufficiently the dangerousness against derailment by the dynamic gauge widening due to the continuous defects of sleepers and rail fasteners, in the inspection for composed materials of railway track etc., and had not implemented the track maintenance corresponding to the inspected results promptly. In addition, it is somewhat likely that the following (1) to (3) also related to the occurrence of the accident. (1) The margin against derailment to the inside of the gauge had become small due to relatively large slack being existed in the curved track. (2) The repetitive generation of remarkably large lateral forces accompanied with train running had promoted gauge widening because there was large alignment due to the angular rotation in the rail joints in the section just before the accident site, for a long term. (3) The guard rail did not demonstrate its function to prevent derailment sufficiently because the width of the flange way was widened dynamically due to the rail tilting and the rail deflection by the lateral force acting on backside of wheel from the left wheel, as the rail fastening forces of the guard rail had deteriorated by the defects in the sleepers and the rail fastening devices, and the guard rail which had not been fastened to each sleeper.



<table>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-2.pdf
http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-2-p.pdf（Explanatory material）</td></tr>
<tr><td rowspan="4">3</td><td>Date of Publication</td><td>Date and accident type</td><td>Railway operator</td><td>Line section (location)</td></tr>
<tr><td>January 25, 2018</td><td>February 11, 2017
Other accidents with casualties</td><td>West Japan Railway Company</td><td>In the premises of Itozaki station, San-yo Line, Mihara City, Hiroshima Prefecture</td></tr>
<tr><td>Summary</td><td colspan="3">The leader of the construction work noticed an abnormal sound when the train had passed by the place for refuge, and then he checked the situation and found that the train watchman had been fallen on the track.
On the other hand, the driver of the train noticed the staffs working ahead while the train had passed Itozaki station at about 68 km/h on schedule at 01:46, but he continued train operation as he thought that the staffs had finished evacuation because he had confirmed the white light waving laterally. After that, he stopped the train obeying the instruction from the train dispatcher after the train had passed Onomichi station.
The train watchman was dead in the accident.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is highly probable that the train watchman in charge of the construction work to replace insulators contacted with the approaching train because he had been standing to watch trains at the position too close to the neighboring track where the railway track was not closed in the accident.
It is somewhat likely that the train watchman was standing to watch trains at the position too close to the neighboring track because he was sure that the watching position was in the safe place.
It is somewhat likely that this situation was related with the complex track shape in around the accident site because the accident had occurred on the turnout. However, it could not be determined the reason because the train watchman was dead in the accident.</td></tr>
<tr><td></td><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-5.pdf
http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-5-p.pdf（Explanatory material）</td></tr>
<tr><td rowspan="4">4</td><td>Date of Publication</td><td>Date and accident type</td><td>Railway operator</td><td>Line section (location)</td></tr>
<tr><td>January 25, 2018</td><td>February 22, 2017
Train Derailment</td><td>Kumamoto Electric Railway</td><td>Between Fujisakigumae station and Kurokami-machi station, Fujisaki Line, Kumamoto City, Kumamoto Prefecture</td></tr>
<tr><td>Summary</td><td colspan="3">The train departed from Fujisakigumae station in one-man operation. Immediately after that, while the train was operated at about 20 km/h in around the Between Kurokami and Fujisaki No.8 level crossing, the driver of the train felt a shock and applied the emergency brake to stop the train.
All axles in the front bogie in the 1st vehicle were derailed to right when the train stopped. The investigation implemented after the accident showed that all axles in the rear bogie of the 1st vehicle had derailed to right once and restored to the track after that.
There were about 50 passengers and the driver onboard the train, but no one was injured.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is probable that left wheels of the 1st axle in the front bogie and all axles in the rear bogie of the 1st vehicle fell to the inside of the gauge, due to the large gauge widening by the passing train in the 200 m radius right curved track, and ran as spreading the gauge, and then the 1st axle in the front bogie derailed to right and the 2nd axle in the front bogie followed to derail, as all axles in the rear bogie had restored to the track by the guardrail, in the accident.
 

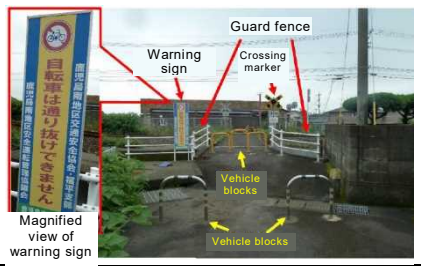
As for the large gauge widening, it is somewhat likely that the gauge was widened dynamically due to the rail tilting etc., caused by the lateral force accompanied with the train running, because the defects of the rail fastening devices had been existed continuously in the curved rack.
Here, it is somewhat likely that the following (1) and (2) related to the occurrence of large</td></tr>
</table>

		gauge widening which caused derailment. (1) The continuous defects of the rail fastening devices as dangerous as to cause derailment and the dangerousness of gauge widening enlarged dynamically could not be found definitely in the periodic inspections etc., and the track maintenance had not been implemented based on the results of the inspection. (2) The margin against derailment to the inside of the gauge had decreased due to the relatively large slack in the curved track.
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-6.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-6-p.pdf (Explanatory material)

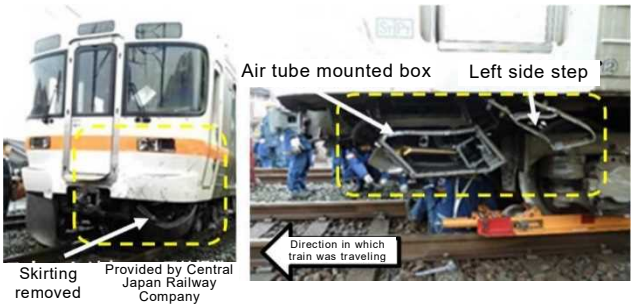
5	Date of Publication	Date and accident type	Railway operator	Line section (location)
	January 25, 2018	March 6, 2017 Level crossing accident	West Japan Railway Company	Senzoku No.1 level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Kuga station and Suo-Takamori station, Gantoku Line, Iwakuni City, Yamaguchi Prefecture

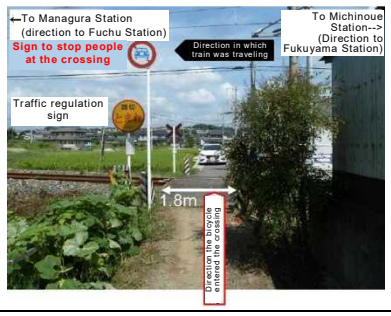
Summary	While the train was running between Kuga station and Suo-Takamori station, the driver of the train noticed a passerby riding bicycle just before reaching Senzoku No.1 level crossing, class 4 level crossing, then applied the emergency brake, but the train collided with the passerby. The passerby was dead in the accident. 
Probable Causes	It is highly probable that the accident occurred as the train collided with a passerby riding bicycle in Senzoku No.1 level crossing, class 4 level crossing without automatic barrier machine nor road warning device, because the passerby riding bicycle had entered the level crossing in the situation that the train was approaching. It is probable that the passerby did not come to a stop just in front of the level crossing and entered the level crossing without confirming the approaching train well, in the situation that the train was approaching. However, it could not be determined the reason why the passerby had entered the level crossing, because the passerby was dead in the accident.
Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-3.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-3-p.pdf (Explanatory material)

6	Date of Publication	Date and accident type	Railway operator	Line section (location)
	January 25, 2018	June 27, 2017 Level crossing accident	Kyushu Railway Company	Between Sakanoue Station and Goino Station on the Ibusuki Makurazaki Line (Kagoshima Prefecture) Mukaihara No.2 level crossing (Class 4 level crossing without automatic barrier machine or road warning device)

Summary	The train driver immediately sounded a whistle and used the emergency brake on discovering a pedestrian entering Mukaihara No.2 level crossing (Class 4 level crossing) while traveling between Sakanoue Station and Goino Station. However, the train hit the pedestrian. The pedestrian died in the accident.
Probable Causes	It is highly probable that the accident occurred as the train collided with a pedestrian entering the level crossing while the train was approaching Mukaihara No.2 level crossing, which is a class 4 level crossing without an automatic barrier machine or road warning device setup at the level crossing. It was not possible to clarify the reason the pedestrian entered the level crossing while the train was approaching because the pedestrian died in the accident.  Magnified view of warning sign

	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-1-4.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-1-4-p.pdf (Explanatory material)		
7	Date of Publication	Date and accident type	Railway operator	Line section (location)
	February 22, 2018	March 2, 2017 Train derailment accompanied with level crossing accident	Central Japan Railway Company	Koyabu level crossing, class 1 level crossing with automatic barrier machine and road warning device, between Nishi-Okazaki station and Anjo station, Tokaido Line, Anjo City, Aichi Prefecture
	Summary	While the train was running between Nishi-Okazaki station and Anjo station at about 120 km/h, the driver of the train noticed a sedan entering Koyabu level crossing, class 1 level crossing, and applied emergency brake immediately but it was too late. The train collided with the sedan and all two axles in the front bogie of the 1st vehicle derailed to right of the track. The sedan completely demolished and burnt after colliding with the train, poles planted along the track side etc. The driver of the sedan was dead, and 3 passengers boarded on the train were injured, in the accident.		
	Probable Causes	It is probable that the accident occurred as the train collided with a sedan entering the Koyabu level crossing, class 1 level crossing, where the automatic barrier machine had completed its operation, in the situation just before the train passed, and derailed to right caused by the lateral force in right direction acted on left under part of front head of the 1st vehicle of the train. It is probable that the forces in right direction had acted to the left under part of front head of the 1st vehicle of the train because the train had been running through as that the sedan collided with the train in the level crossing had been crashed being sandwiched by the train and poles planted in the left side of the train. It could not be determined the reason why the sedan had entered the level crossing where the automatic barrier machine had completed its operation, because the driver of the sedan was dead in the accident.		
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-2-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-2-1-p.pdf (Explanatory material)		
8	Date of Publication	Date and accident type	Railway operator	Line section (location)
	March 29, 2018	September 7, 2017 Level crossing accident	West Japan Railway Company	Iwasakinoichi level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Michinoue station and Managura station, Fukuen Line, Fukuyama City, Hiroshima Prefecture
	Summary	While the train was running between Michinoue station and Managura station, the driver of the train noticed a motorized bicycle entering Iwasakinoichi level crossing, class 4 level crossing, then sounded a whistle and applied the emergency brake immediately, but the train collided with the motorized bicycle. The driver of the motorized bicycle was dead in the accident.		
	Probable Causes	It is highly probable that the accident occurred as the train collided with the motorized bicycle at Iwasakinoichi level crossing, class 4 level crossing without automatic barrier		





		machine nor road warning device, because the motorized bicycle had entered the level crossing in the situation that the train was approaching. It is probable that the driver of the motorized bicycle had not come to a stop just in front of the level crossing and had entered the level crossing in the situation that the train was approaching, without confirming the approaching train well. However, it could not be determined the reason why the motorized bicycle had entered the level crossing, because the driver of the motorized bicycle was dead in the accident.
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-3-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-3-1-p.pdf (Explanatory material)

9	Date of Publication	Date and accident type	Railway operator	Line section (location)
	March 29, 2018	September 18, 2017 Level crossing accident	Kyushu Railway Company	Ebe level crossing, class 3 level crossing equipped with road warning device but without automatic barrier machine, between Uto station and Midorikawa station, Misumi Line, Uto City, Kumamoto Prefecture

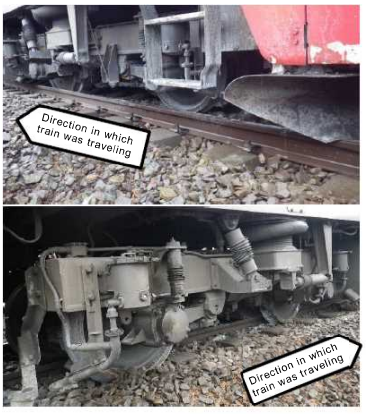
	Summary	While the train was running between Uto station and Midorikawa station, the driver of the train noticed a bicycle entering Ebe level crossing, class 3 level crossing, then applied the emergency brake and sounded a whistle immediately, but the train collided with the bicycle. The rider of the bicycle was dead in the accident.
	Probable Causes	It is highly probable that the accident occurred as the train collided with a bicycle at Ebe level crossing, class 3 level crossing equipped with the road warning device but without the automatic barrier machine, because the rider of the bicycle had entered the level crossing in the situation that the road warning device was operating according to the approaching train. It could not be determined the reason why the rider of the bicycle had entered the level crossing, in the situation that the approaching train could be noticed by the operation of the road warning device according to the approaching train, because the rider of the bicycle was dead in the accident, even though it is somewhat likely that the certain confirmation of safety had not been implemented in relation with that the rider of the bicycle had not had a margin in the required time to go to the destination.
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-3-2.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-3-2-p.pdf(Explanatory material)

10	Date of Publication	Date and accident type	Railway operator	Line section (location)
	June 28, 2018	May 22, 2017 Train derailment	Watarase Keikoku Railway Co., Ltd.	Between Hanawa station and Mizunuma station, Watarase Keikoku Line, Kiryu City, Gunma Prefecture

	Summary	The driver of the train felt a shock just after the train had passed through the 160 m radius right curved track, between Hanawa station and Mizunuma station, at about 36 km/h at about 14:59, then applied an emergency brake to stop the train. After the train had stopped, the driver checked the situation and found that all axles in the front bogie of the 2nd vehicle had derailed to left. There were 7 persons, i.e., the train crews and the staff in charge of railway facilities etc., onboard the train, but no one was injured.

	Probable Causes	It is probable that the accident occurred as the right wheel in the 1st axle of the front bogie of the 2nd vehicle fell off to the inside of the gauge and continued running being spread gauge, and then the left wheel flange in the front bogie climbed up to outer left rail and derailed to left, because the gauge was widened while the train, the electric and track inspection cars, was passing in the 160 m radius right curved track. It is probable that the gauge widening was caused by the rail tilting etc., due to lateral forces accompanied with train running in the curved track where the continuous defective sleepers and rail fastening devices were existed. It is somewhat likely that the existence of significantly large gauge widening to cause derailment was related with that the proper track maintenance had not been implemented because the danger against gauge widening by the continuous defective sleepers and rail fastening devices had not been recognized in the periodic inspection etc., and the proper operation control and the track maintenance had not been implemented even though the remarkably large irregularity of gauge had been detected in the measurement by the track inspection cars just before the accident.  1st axle of the front bogie of the 2nd vehicle Left wheel
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-4-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-4-1-p.pdf (Explanatory material) See "Feature 2: Summaries of major railway accident and serious incident investigation reports (case studies)", page 44

11	Date of Publication	Date and accident type	Railway operator	Line section (location)
	July 26, 2018	February 23, 2017 Train Derailment	Japan Freight Railway Company	In the premises of Kita-Irie signal station, Muroran Line, Toyako Town, Abuta District, Hokkaido

	Summary	While the train was running in the premises of Kita-Irie signal station at about 54 km/h, the driver of the train stopped the train by the emergency brake as he felt abnormal vibration, and operated the train protection radio. After he had reported the situation to the train dispatcher, he checked the vehicles and found that the 5th and 6th axles in total six axles of the front, middle and rear bogies of the 1st vehicle, i.e., the locomotive, had derailed to right side of the direction of the train. Then, he reported the situation to the train dispatcher. There was the driver onboard the train, but he was not injured.
	Probable Causes	It is probable that the accident occurred as all axles, i.e., the 5th and 6th axles, in the rear bogie in the 1st vehicle, i.e., the locomotive, of the freight train derailed because the traction device had hung down due to the removal of two fitting bolts fastening the center pin and the traction device in the rear bogie during running operation, following the process described in below. (1) The left traction link broke when the traction device hit the left guard rail in the Iriechou level crossing. (2) The wheels in all axles, i.e., the 5th and 6th axles, in the rear bogie derailed to right due to the lateral force in right direction acted on the traction device, as the traction device, hanging more after broken, hit the lead rail of the turnout in the premises of Kita-Irie signal station. It is somewhat likely that the fitting bolts of the traction device fell away because the fitting bolts had come looser due to vibration etc., during train running after finished the important parts inspection, in which the work to connect bogie and vehicle body had finished in the status that the fitting bolts had fastened temporarily, i.e., the fitting bolts had not been fastened with the determined fastening torque.  5th axle and 6th axle derailed

		It is somewhat likely that the work connecting bogie and vehicle body finished as the fitting bolts had not been fastened by the determined fastening torque, because the works to fasten bolts had been implemented without using the torque wrench and the confirmation of the fastened status had not been implemented, as the assigned role for each worker and the procedures of each work for the bolt fastening works, had not been clearly prescribed.
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-5-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-5-1-p.pdf (Explanatory material) See "Feature 2: Summaries of major railway accident and serious incident investigation reports (case studies)", page 45

12	Date of Publication	Date and accident type	Railway operator	Line section (location)
	July 26, 2018	September 18, 2017 Heavy property loss without casualties	Kyushu Railway Company	In the premises of Nogata station, Chikuho Line, Nogata City, Fukuoka Prefecture

Summary

The train started the shunting operation in the route from track 25 to the east lead track No.1 via track 15 in the premises of Nogata station, at about 05:15. After that, the vehicles collided with the car stop installed in the end edge of the east lead track No.1 and destroyed it, furthermore, all two axles in the front bogie of the front vehicle derailed to right by the shock and the vehicle body of the front vehicle disturbed the main line in the up track.

As the measures such as train protection etc., accompanied with disturbing main line in the up track had not been implemented, the inbound Electric 6520H train, composed of 3 vehicles, and the shunting vehicles for outbound Deadhead Diesel 1533D train, shunting vehicles composed of four vehicles scheduled to be operated as the outbound Deadhead Diesel 1533D train, were passing through the disturbed track, and the car side pilot lamp of the shunting vehicle of the outbound Deadhead Diesel 1533D train contacted with the right edge of the front head of the shunting vehicle of the inbound Electric 6620M train and both vehicles were damaged.

There was a driver boarded on the shunting vehicles for the inbound Electric 6620M train and the shunting vehicles of the outbound Deadhead Diesel 1533D train, each, but no one was injured.

Probable Causes

It is highly probable that the heavy property loss was induced in the railway facilities and the vehicles in the accident, as the vehicle collided with the car stop installed in the end edge of the track because the driver operating vehicles in shunting operation in the premises of Nogata station missed the timing of the braking operation, and the vehicle passing in the main line in the up track contacted with the vehicle derailed by the shock of the collision with the car stop and disturbed the main line in the up track.

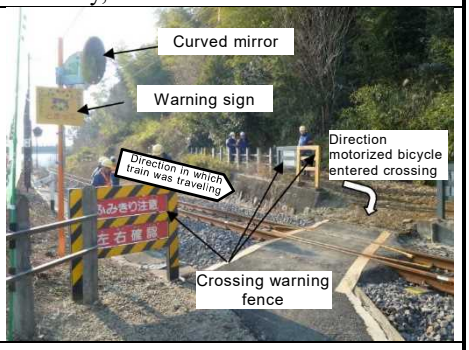
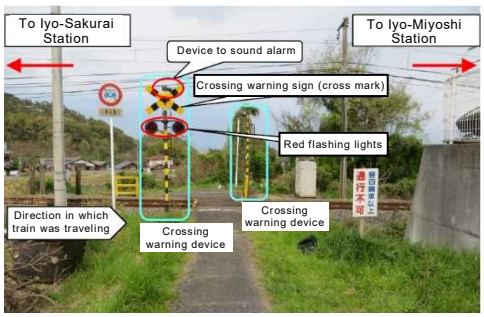
It is somewhat likely that the driver missed the timing of the braking operation related with temporary misunderstanding of the shunting route for the other vehicles as the route for his vehicles as he did not concentrate awareness to confirm safety of his route in the shunting operation.

It is probable that the derailed vehicle contacted with the vehicle passing the main line in the up track in relation with that the procedure of train protection was not implemented promptly after the derailment had occurred.

It is somewhat likely that the train protection procedure was not implemented promptly even though the derailed vehicle had disturbed the main line in the up track after the derailment, because the driver of the derailed vehicle had considered that the derailed vehicle was not in the situation as to disturb the neighboring main line in the up track as the deviation was not so large, although he had noticed the fact of the derailment.

Report

http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-5-2.pdf
http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-5-2-p.pdf (Explanatory material)

<table>
<tr><td></td><td></td><td colspan="3">See “Feature 2: Summaries of major railway accident and serious incident investigation reports (case studies)”, page 46</td></tr>
<tr><td rowspan="4">13</td><td>Date of Publication</td><td>Date and accident type</td><td>Railway operator</td><td>Line section (location)</td></tr>
<tr><td>September 27, 2018</td><td>January 16, 2018
Level crossing accident</td><td>Central Japan Railway Company</td><td>Bozuyama level crossing, class 4 level crossing without automatic barrier machine nor road warning device, between Idagawa station and Kasado station, Kansai Line, Suzuka City, Mie Prefecture</td></tr>
<tr><td>Summary</td><td colspan="3">While the train was running at about 82 km/h between Idagawa station and Kasado station, the driver of the train noticed the motorized bicycle entering Bozuyama level crossing, class 4 level crossing, then applied emergency brake and sounded a whistle, but the train collided with the motorized bicycle.
The driver of the motorized bicycle was dead in the accident.
 
</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is probable that the accident occurred as the train collided with the motorized bicycle at Bozuyama level crossing, class 4 level crossing without automatic barrier machine nor road warning device, because the motorized vehicle had entered the level crossing in the situation that the train was approaching.
It could not be determined the reason why the motorized bicycle had entered the level crossing in the situation that the train was approaching, because the driver of the motorized bicycle was dead in the accident.</td></tr>
<tr><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-6-1.pdf
http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-6-1-p.pdf(Explanatory material)
See “Feature 2: Summaries of major railway accident and serious incident investigation reports (case studies)”, page 47</td></tr>
<tr><td rowspan="4">14</td><td>Date of Publication</td><td>Date and accident type</td><td>Railway operator</td><td>Line section (location)</td></tr>
<tr><td>September 27, 2018</td><td>April 11, 2018
Level crossing accident</td><td>Shikoku Railway Company</td><td>Takabayashi level crossing, class 3 level crossing equipped with road warning device but without automatic barrier machine, between Iyo-Sakurai station and Iyo-Miyoshi station, Yosan Line, Saijo City, Ehime Prefecture</td></tr>
<tr><td>Summary</td><td colspan="3">While the train was running at about 81 km/h between Iyo-Sakurai station and Iyo-Miyoshi station, the driver of the train noticed a public person lying down in Takabayashi level crossing, class 3 level crossing, then applied the emergency brake immediately, but the train hit the public person.
The public person was dead in the accident.</td></tr>
<tr><td>Probable Causes</td><td colspan="3">It is probable that the accident occurred as the train hit the public person at Takabayashi level crossing, class 3 level crossing equipped with road warning device, because the public person was lying down in the level crossing in the situation that the road warning device was operating according to the approaching train.
It could not be determined the reason why the public person was lying down in the level crossing because the public person was dead in the accident.
 
</td></tr>
<tr><td>Report</td><td colspan="3">http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-6-2.pdf
http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-6-2-p.pdf（Explanatory material）</td></tr>
<tr><td>15</td><td>Date of</td><td>Date and accident</td><td>Railway operator</td><td>Line section (location)</td></tr>
</table>

	Publication	type		
	October 25, 2018	December 16, 2017 Other accidents with casualties	Japan Freight Railway Company	In the premises of Chihaya yard, Kagoshima Line, Fukuoka City, Fukuoka Prefecture
	Summary	The company staff in charge of signal engaged in the work to ignite snow melting device for switches installed in the turnouts, contacted with the inbound 2352M train composed of 6 vehicles started from Kurume station bound for Kokura station of Kyushu Railway Company. On the other hand, the driver of the train applied the emergency brake to stop the train as he had noticed an abnormal sound. The driver checked the situation and found that the staff in charge of signal had been fallen down. The staff in charge of signal was dead in the accident.		
	Probable Causes	It is highly probable that the accident occurred as the staff in charge of signal had entered the up track of Kagoshima Line where the train was running, when the staff in charge of signal and the switchman had been working to ignite the snow melting devices for switches, individually, without staff in charge of watching train. It is probable that the staffs were working to ignite snow melting devices individually without the watchman, as the training about safety for the company staffs in charge of the work had been insufficient, and their understanding about the importance of watching duties was poor. It could not be determined the reason why the staff in charge of signal had entered the up track of Kagoshima Line, because the staff in charge of signal was dead in the accident.		
	Report	http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2018-7-1.pdf http://www.mlit.go.jp/jtsb/railway/p-pdf/RA2018-7-1-p.pdf (Explanatory material)		

Railway serious incidents reports published in 2018

There were no railway serious incidents reports published in 2018.

7 Actions taken in response to opinions in 2018 (railway accidents and serious incident)

A summary of the actions taken in response to opinions in 2018 is as follows.

(1) Opinions on the prevention of train derailments caused by gauge widening

(Opinions on June 28, 2018)

See “Chapter 1: Summary of recommendations and opinions issued in 2018 – 2 Opinions” (Page 62 (2))

(2) Opinions on the railway serious incident (Dangerous trouble in vehicle) for trains operated by the West Japan Railway Company that occurred on the Tokaido Shinkansen Line

(Opinions on June 28, 2018)

See “Chapter 1: Summary of recommendations and opinions issued in 2018 – 2 Opinions” (Page 77 (3))

8 Provision of factual information in 2018 (railway accidents and serious incidents)

The JTSB provided factual information for 1 case in 2018. The content is as follows.

(1) Provision of information relating to the railway serious incident that occurred at Shin-Sapporo Station on the JR Hokkaido Chitose Line

(Provided information on November 14, 2018)

The Japan Transport Safety Board provided information to the Railway Bureau of MLIT on November 14, 2018 relating to the railway serious incident that occurred on the premises of Shin-Sapporo Station on the JR Hokkaido Chitose Line on November 9, 2018.

（Summary of railway serious incidents）

On November 9, 2018 (Friday), the 1st outbound departure signal had collapsed onto the tracks and was lying across the inbound and outbound lines. The outbound local train stopped approximately 15 m in front of the collapsed signal after the driver discovered the obstacle (signal) was on the track.

(Provided information)

The collapsed signal pole was installed onto an elevated bridge and anchors and bolts were used to secure it to the concrete frame of the elevated bridge. However, all 8 anchors driven into the concrete frame had come loose and the cone (wedge) had remained inside the hole of the frame.

Furthermore, the anchors were made so that their slitted sections would spread out due to the cone when driven into the concrete. However, none of the anchors that had come loose were spread out at the slitted sections.

A detailed investigation is scheduled in the near future for the cause of this serious incident.

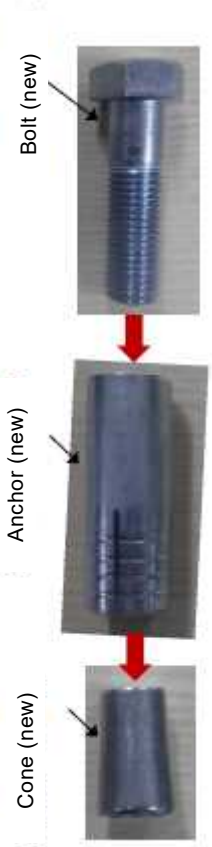
Stand of collapsed signal (bottom surface)

Anchor (bottom surface)

Anchor (side)

Location where collapsed signal was standing

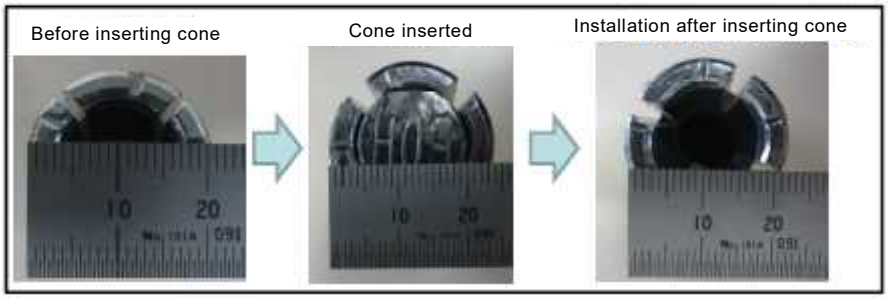
Cone remain inside hole



Construction method
- A hole is made using a drill in the concrete frame and a cone and anchor inserted
- A hammer is used to drive in the anchor so that the bottom of the anchor opens out and is secured to the concrete frame
- A bolt is inserted into the anchor to fasten it and secure the signal foundations

Left: Installation after inserting cone
Right: Before inserting cone

Left: Installation after inserting cone
Right: Before inserting cone



* The information provided can be found on the JTSB website.
http://www.mlit.go.jp/jtsb/iken-teikyo/JRsinsapporo20181109.pdf

Column

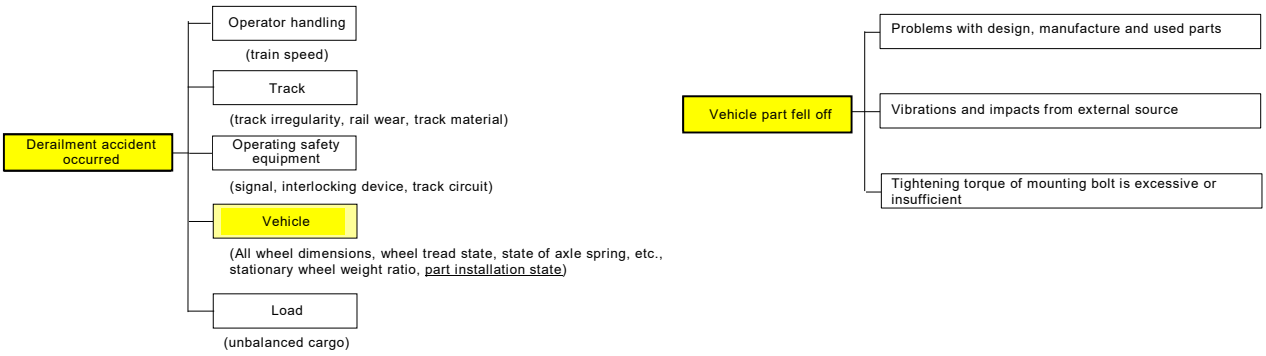
Analyzing the cause of derailment accidents involving parts that fall off the railway vehicle

Railway Accident Investigator

Derailment accidents caused by parts falling off railway vehicles have occurred in the past.

When a derailment accident occurs, during the initial investigation, it is important to investigate for any evidence that connects the derailment to the track and the railway vehicle bogie (axle, bearing, bogie frame, etc.), and if there is any damage. Also, these findings are separated from any evidence that occurred due to impact or similar forces that occurred after the derailment, and analysis is conducted on why the train derailed, which wheel was first to derail, and how the train progressed after the derailment while cross-referencing the track and train damage, evidence (marks on the track ballast, rail top surface and the wheel tread).

To analyze the cause of the derailment, a more detailed investigation is conducted on data from such as the operating status recording device, the track, the vehicle, and inspection records for the operating safety equipment, in addition to such things as measurement results from the track and the vehicle after the derailment accident occurred. Based on analysis conducted so far, derailment accidents occur due to the factors indicated below. However, it only shows items caused by the vehicle.



Factors involving the derailment accident occurrence (Ex.)

Factors involving the train parts falling off (Ex.)

For example, when it is discovered that a vehicle part that was attached using a mounting bolt fell off, the investigation is conducted focusing on the following items.

- The state immediately after the accident occurred
  ⇒Was the bolt broken? Did it come off? Is it in poor condition?
- When the part was installed
  ⇒When was the part installed? Was the correct torque used for the mounting bolt?
- Inspection after the part was installed
  ⇒Was a visual inspection or hammering test performed to test the installation? What was the inspection/test results? During a past investigation, we understood that it is not easy to accurately determine the fastened state during a hammering test such as when a large load is acting on the fastened point.
- Part degradation over time, presence of fatigue fractures
  ⇒Is the part worn or broken? Conduct a test such as a fracture investigation and flaw detection test.

- Presence of external factors that lead to the part falling off
  ⇒Does abnormal vibration occur on the train part caused by the vehicle itself or the track, or an external impact (such as flying objects). In the past, vibration generated by wheel tread detachment led to parts falling off.
- Defects when the part was manufactured
  ⇒Conduct an interview survey, etc., to ask the manufacturer about the part.
- Progression of the part falling off
  ⇒Verify the progression until the part fell off using a simulation and reproduction test that imitates the actual conditions of the vehicle when it was traveling. It is not easy to reproduce the conditions that were present at the time of the accident. However, it is effective to analyze the factors when the accident occurred.

The above are examples but all possibilities that lead to the accident should be considered and appropriate accident investigations are conducted to thoroughly investigate the cause of the accident.

Chapter 5 Marine accident and incident investigations

1 Marine accidents and incidents to be investigated

<Marine accidents to be investigated>

◎Paragraph 5, Article 2 of the Act for Establishment of the Japan Transport Safety Board

(Definition of marine accident)

The term "Marine Accident" as used in this Act shall mean as follows:

1 Damage to a ship or facilities other than a ship related to the operations of a ship.

2 Death or injury of the people concerned with the construction, equipment or operation of a ship.

<Marine incidents to be investigated>

◎Item 2, paragraph 6, Article 2 of the Act for Establishment of the Japan Transport Safety Board (Definition of marine incident)

A situation, prescribed by Ordinance of Ministry of Land, Infrastructure, Transport and Tourism, where deemed to bear a risk of Marine Accident occurring.

◎Article 3 of Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board

(A situation, prescribed by Ordinance of the Ministry of Land, Infrastructure, Transport and Tourism, stipulated in item 2, paragraph 6, Article 2 of the Act for Establishment of the Japan Transport Safety Board)

1 The situation wherein a ship became a loss of control due to any of the following reasons:

(a) navigational equipment failure;

(b) listing of a ship; or

(c) short of fuel or fresh water required for engine operation.

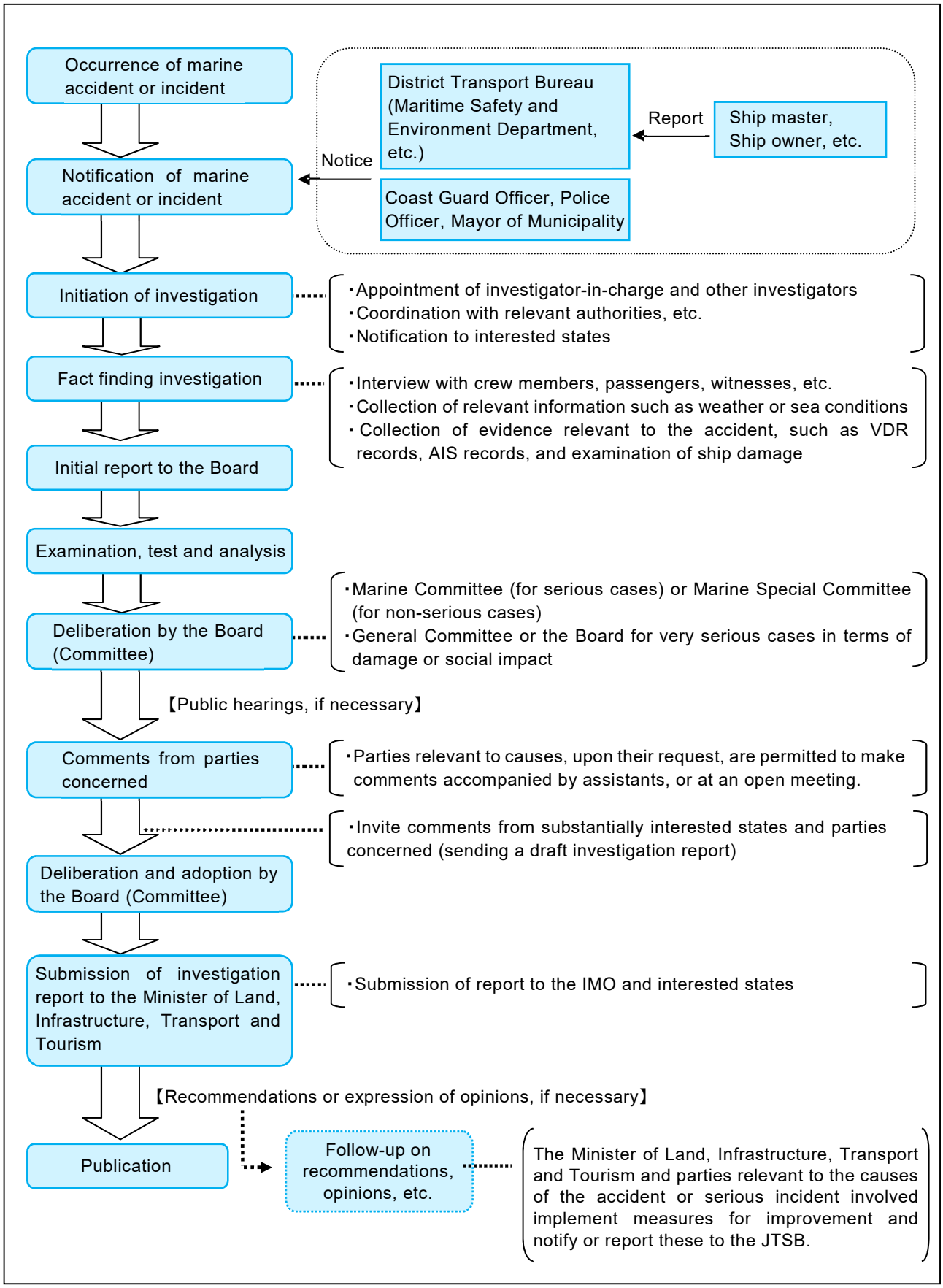
2 The situation where a ship grounded without any damage to the hull; and

3 In addition to what is provided for in the preceding two items, the situation where safety or navigation of a ship was obstructed.

<Category of marine accident and incident>

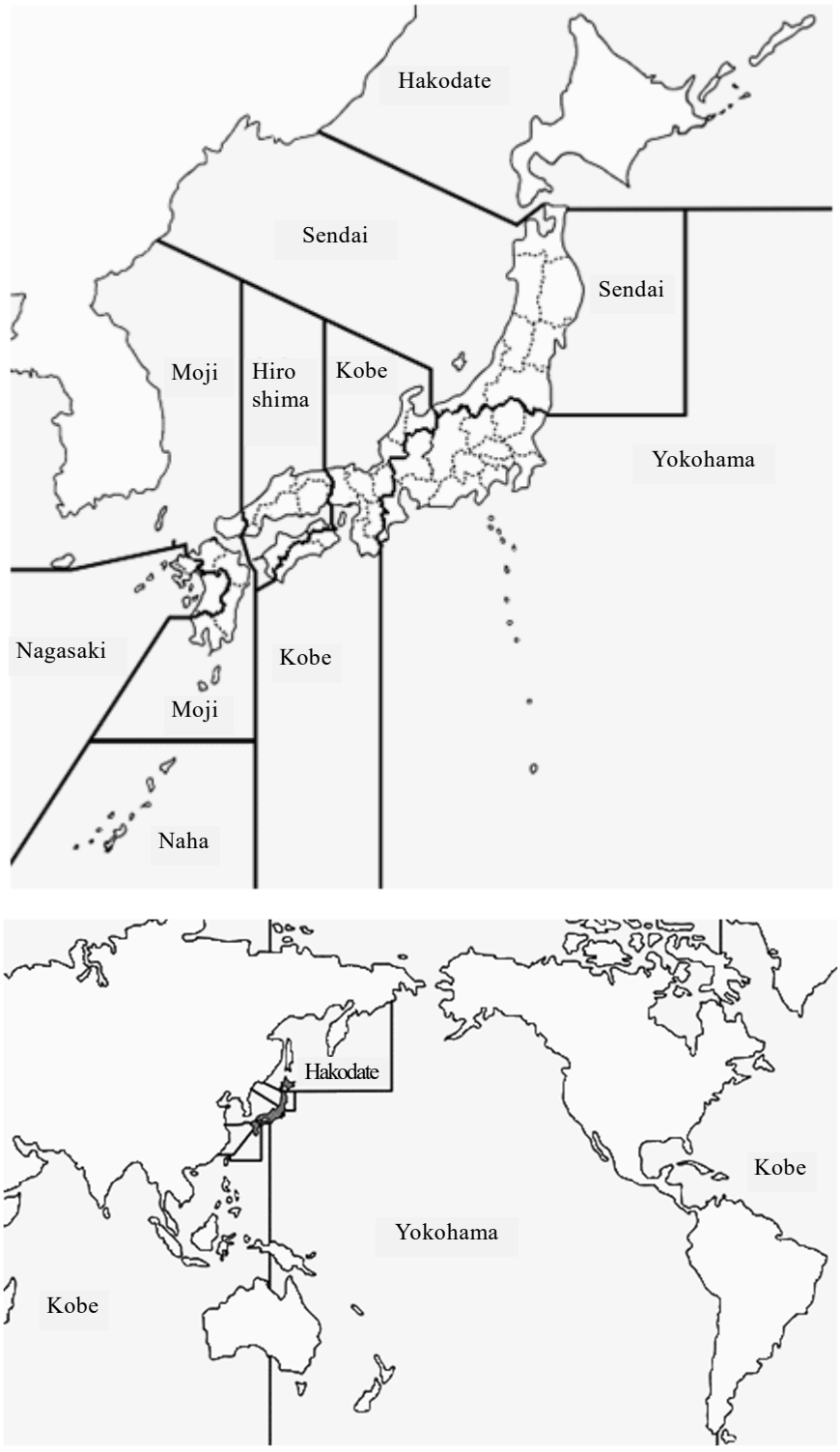
Marine accident and incident to be investigated		Type of marine accident and incident
Marine accident	Damage to ships or other facilities involved in ship operation	Collision, Grounding, Sinking, Flooding, Capsizing, Fire, Explosion, Missing, Damage to facilities
	Casualty related to ship structures, equipment or operations	Fatality, Fatality and injury, Missing person, Injury
Marine incident	Navigational equipment failure	Loss of control (engine failure, propeller failure, rudder failure)
	Listing of ship	Loss of control (extraordinary listing)
	Short of fuel or fresh water required for engine operation	Loss of control (fuel shortage, fresh water shortage)
	Grounding without hull damage	Stranded
	Obstruction of ship safety or navigation	Safety obstruction, Navigation obstruction

2 Procedure of marine accident/incident investigation



3 Jurisdiction of the Offices over marine accidents and incidents

For the investigation of marine accidents and incidents regional investigators are stationed in the regional offices (eight offices). Our jurisdiction covers marine accidents and incidents in the waters around the world, including rivers and lakes in Japan. The regional offices are in charge of investigations in the respective areas shown in the following map. Marine accident investigators in the Tokyo Office (Headquarters) are in charge of serious marine accidents and incidents.



Jurisdiction map

4 Role of the Offices and Committees according to category of accident and incident

Serious marine accidents and incidents are investigated by the marine accident investigators in the Headquarters, and are deliberated in the Marine Committee. However, particularly serious accidents are deliberated in the General Committee, and extremely serious accidents are deliberated in the Board.

Non-serious marine accidents and incidents are investigated by regional investigators stationed in the eight regional offices, and deliberated in the Marine Special Committee.

(For the deliberation items of the Board and each Committee, refer to page 2 of the Appendixes)

<table>
<tr><td>Serious marine accidents and incidents</td><td>Office in charge of investigation: Marine accident investigators in the Headquarters
Committee in charge of deliberation and adoption: Marine Committee</td></tr>
<tr><td colspan="2">Definition of ”serious marine accidents and incidents”
•Cases where a passenger died or went missing, or two or more passengers were severely injured.
•Cases where five or more persons died or went missing.
•Cases involved a vessel engaged on international voyages where the vessel was a total loss, or a person on the vessel died or went missing.
•Cases of spills of oil or other substances where the environment was severely damaged.
•Cases where unprecedented damage occurred following a marine accident or incident.
•Cases which made a significant social impact.
•Cases where identification of the causes is expected to be significantly difficult.
•Cases where essential lessons for the mitigation of damage are expected to be learned.</td></tr>
<tr><td>Non-serious marine accidents and incidents</td><td>Office in charge of investigation: Regional investigators in the regional offices
Committee in charge of deliberation and adoption: Marine Special Committee</td></tr>
</table>

5 Statistics of investigations of marine accidents and incidents (As of end of February 2019)

The JTSB carried out investigations of marine accidents and incidents in 2018 as follows:

531 accident investigations had been carried over from 2017, and 828 accident investigations were newly launched in 2018. 757 investigation reports were published in 2018, and thereby 596 accident investigations were carried over to 2019.

91 incident investigations had been carried over from 2017, and 130 incident investigations were newly launched in 2018. 131 investigation reports were published in 2018, and thereby 90 incident investigations were carried over to 2019.

Investigations of marine accidents and incidents in 2018

(Cases)

Category	Carried over from 2017	Launched in 2018	Not applicable	Transferred to Tokyo Office	Total	Publication of investigation report	(Recommendations)	(Safety recommendations)	(Opinions)	Carried over to 2019	(Interim report)
Marine accident	531	828	△6	0	1,353	757	(1)	(1)	(2)	596	(1)
Tokyo Office (Serious cases)	13	19	△1	2	33	12	(1)	(1)	(2)	21	(1)
Regional Offices (Non-serious cases)	518	809	△5	△2	1,320	745				575	
Marine incident	91	130	0	0	221	131	(0)	(0)	(0)	90	(0)
Tokyo Office (Serious cases)	1	1	0	1	3	2				1	
Regional Offices (Non-serious cases)	90	129	0	△1	218	129				89	
Total	622	958	△6	0	1,574	888	(1)	(1)	(2)	686	(1)

Note 1. The figures for “Launched in 2018” includes cases which occurred in 2017 or earlier, and which the JTSB was notified of in 2017 as subjects of investigation.

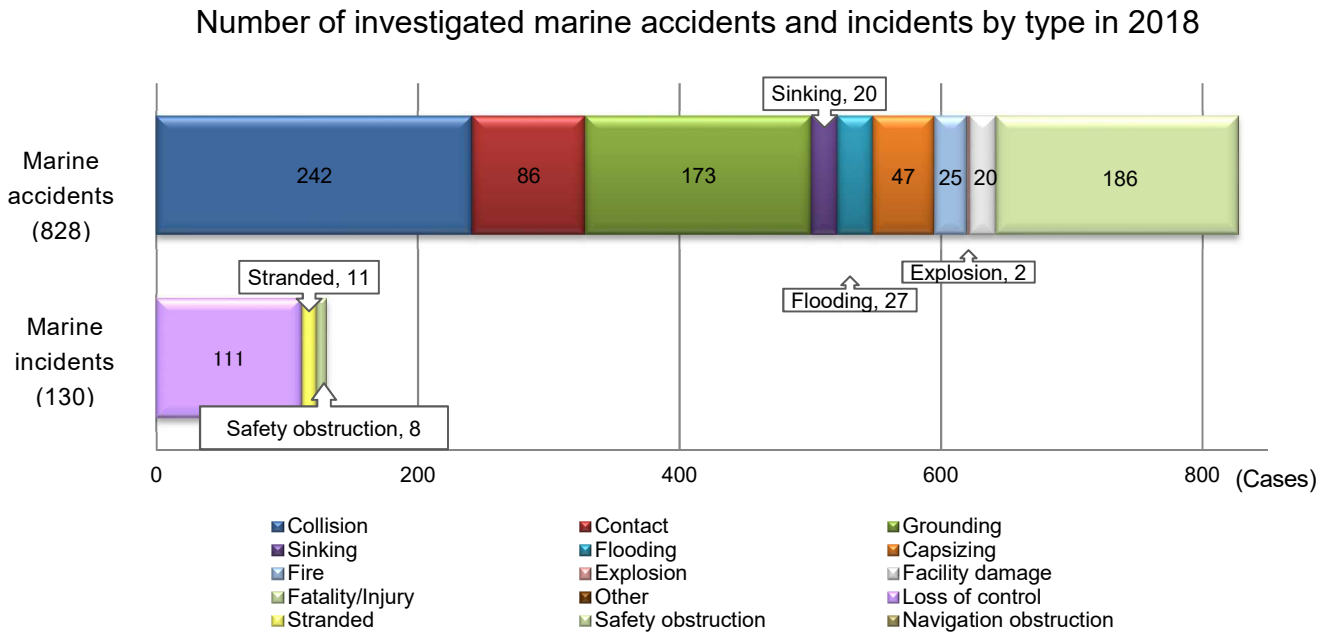
Note 2: The column “Not applicable” shows the number of cases which did not come under the category of accident or incident as defined in Article 2 of the Act for Establishment of the Japan Transport Safety Board.

Note 3: The column “Transferred to Tokyo Office” shows the number of cases where the investigation found out that it was serious and the jurisdiction was transferred from the regional office to the Tokyo Office.

6 Statistics of investigations launched in 2018 (As of end of February 2019)

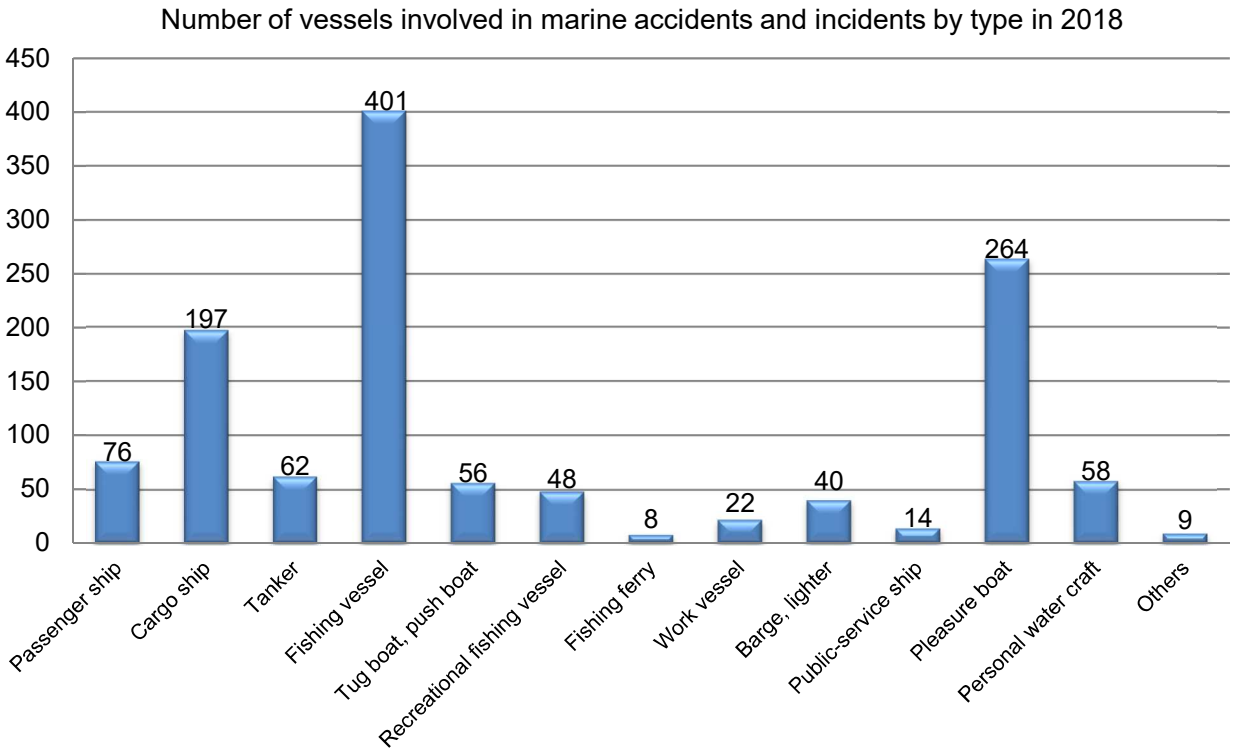
(1) Types of accidents and incidents

The breakdown of the 958 investigations launched in 2018 by type of accidents and incidents is as follows: The marine accidents included 242 cases of collision, 186 cases of fatality/injury (not involved in other types of accidents), 173 cases of grounding, and 86 cases of contact. The marine incidents included 111 cases of loss of control, 8 cases of navigation obstruction, and 11 cases of stranded. The objects of contact were quays in 23 cases, breakwaters in 21 cases, and piers in nine cases.



(2) Types of vessels

The number of vessels involved in marine accidents and incidents was 1,255. By type of vessel, they included 401 fishing vessels, 264 pleasure boats, 197 cargo ships, 76 passenger ships, and 62 tankers.



The number of foreign-registered vessels involved in marine accidents and incidents was 71, and they were classified by accident type as follows: 47 vessels in collision, nine vessels in contact and six vessels in grounding. As for the flag of vessels, 21 vessels were registered in South Korea, 20

vessels in Panama, seven vessels in Belize, five vessels in Sierra Leone.

Number of foreign-registered vessels by flag

(Vessels)

South Korea	21	Sierra Leone	5	Singapore	2
Panama	20	Hong Kong	4	China	2
Belize	7	Marshall Islands	3	Others	7

(3) Number of casualties

The number of casualties was 451, consisting of 83 deaths, 11 missing persons, and 357 injured persons. By type of vessel, 138 persons in fishing vessels and 108 persons in pleasure boats. By type of accident, 210 persons in fatality/injury, 126 persons in collision, 58 persons in contact, 22 persons in grounding, and 21 persons in capsizing.

With regard to the number of persons dead or missing, 54 persons were involved in fishing vessel accidents, 21 persons in pleasure-boat accidents, indicating dead or missing cases occurred frequently in fishing vessels.

Number of casualties (marine accident)

(Persons)

2018										
Vessel type	Dead			Missing			Injured			Total
	Crew	Passengers	Others	Crew	Passengers	Others	Crew	Passengers	Others	
Passenger ship	0	0	1	0	0	0	6	42	4	53
Cargo ship	2	0	0	0	0	0	8	0	7	17
Tanker	1	0	1	0	0	0	5	0	0	7
Fishing vessel	45	0	0	9	0	0	81	0	3	138
Tug boat, push boat	0	0	0	0	0	0	6	0	0	6
Recreational fishing vessel	0	1	0	0	0	0	6	21	1	29
Fishing ferry	0	0	0	0	0	0	2	16	0	18
Work vessel	2	0	0	0	0	0	1	0	2	5
Barge, lighter	0	0	2	0	0	0	0	0	5	7
Public-service ship	1	0	0	0	0	0	0	0	0	1
Pleasure boat	8	0	11	1	0	1	33	1	53	108
Personal water craft	3	0	4	0	0	0	12	2	37	58
Others	1	0	0	0	0	0	1	0	2	4
Total	63	1	19	10	0	1	161	82	114	451
	83			11			357			

※ The figures above include accidents under investigation and therefore are subject to change depending on the course of investigations and deliberations.

7 Summaries of serious marine accidents and incidents which occurred in 2018

The serious marine accidents which occurred in 2018 are summarized as follows: The summaries are based on information available at the initial stage of the investigations and therefore are subject to change depending on the course of investigations and deliberations.

(Marine accidents)

1	Date and location	Vessel type and name, accident type
	March 18, 2018 Approximately 6km off Eigashima Port, Akashi City, Hyogo Prefecture (Kantama South Light Buoy)	Passenger Ferry Fukuoka II Contact with a light buoy
	Summary	The vessel contacted Kantama South Light Buoy at the stern while transporting an emergency patient on board.
2	Date and location	Vessel type and name, accident type
	March 24, 2018 Off the south-southwest coast of Ashizuri-misaki Cape, Tosashimizu City, Kochi Prefecture	Cargo vessel GENIUS STAR VIII (Vessel A, Panama) Cargo vessel Tokuhomaru No. 11 (Vessel B) Collision
	Summary	Vessel A, with the master, officers, and 16 other crew members on board, was drifting off the south-southwest coast of Ashizuri-misaki Cape, Tosashimizu City, Kochi Prefecture. At the same time, Vessel B, with the master and four other crew members on board, was heading east-northeast toward Keihin Port Tokyo District. Then Vessel B collided with Vessel A off the south-southwest coast of Ashizuri-misaki Cape. The collision caused Vessel A cracks and other damage on the vessel-side outer plate in the portside rear. The accident also caused crashing into Vessel B at the bow. There were no casualties on either vessel
3	Date and location	Vessel type and name, accident type
	April 2, 2018 Keihin port, Tokyo district 3, No. 10-1 Multi-purpose Terminal M-P	Training ship NIPPONMARU Fatality of a cadet
	Summary	When the vessel was moored at Keihin port, Tokyo district 3, No. 10-1 Multi-purpose Terminal M-P with the captain, one navigation officer, boatswain, and 49 crew taking 105 cadets onboard, during lay aloft training at the foremast, one of the cadets fell from the foremast to the superstructure deck and died.
4	Date and location	Vessel type and name, accident type
	April 5, 2018 Niigata Port West Port District, Niigata Prefecture	Passenger Ferry YUUKARI Injury of a crew member
	Summary	This vessel, with the master and 31 other crew members on board, was loading vehicles at the south quay of Yamanoshita Warf, Niigata Port West Port District, Niigata City, Niigata Prefecture. The second officer who was supervising the loading operation on the vehicle deck was run over by the rear-right wheel of a trailer moving back (with the head – the vehicle that pulls the chassis – and the chassis connected) on both legs. The officer suffered severe injuries, including below-knee compartment syndrome in both legs.
5	Date and location	Vessel type and name, accident type
	April 8, 2018 Off to the southeast of Kunisaki Port, Kunisaki City, Oita Prefecture	Chemical Tanker GOLDEN SUNNY HANA Explosion (Cargo oil tank)
	Summary	The vessel, with a master and 14 crew members on board, was proceeding southeast off to the southeast of Kunisaki Port, Oita Prefecture, while conducting cleaning work in a cargo oil tank, an explosion occurred in the cargo oil tank. Two of the vessel's ordinary seamen were injured and her cargo oil tanks had holes and other damage.
6	Date and location	Vessel type and name, accident type
	May 4, 2018	Container vessel NYK VENUS (Vessel A)

	Hanshin Port, Kobe Area , South off the coast	Container vessel SITC OSAKA (Vessel B) Collision
	Summary	Vessel A and Vessel B collided with each other off Rokko Island
7	Date and location	Vessel type and name, accident type
	May 8, 2018 Off the west coast of Koshikijima island, Kagoshima Prefecture	Fishing vessel SHOTOKUMARU No. 87 Sinking
	Summary	The vessel, loaded with catches of fish, was navigating off the west coast of Koshikijima island, Kagoshima Prefecture, and navigating toward Mieshikimi Port, Nagasaki Prefecture. When receiving waves from the starboard bow, the hull listed and sank. A consort rescued all crew members who escaped from the vessel in a life raft.
8	Date and location	Vessel type and name, accident type
	June 20, 2018 Approximately 460 nautical miles off the east southeast coast of Kinkazan, Miyagi Prefecture	Fishing vessel KORYOMARU No. 68 Flooding
	Summary	In the waters approximately 460 nautical miles off the east southeast coast of Kinkazan, Miyagi Prefecture, the vessel flooded and the hull listed to the port side. A consort rescued all the 18 crew members on board.
9	Date and location	Vessel type and name, accident type
	July 26, 2018 In the southern waters of Ondo no Seto, Kure City, Hiroshima Prefecture	Ferry ISHITEGAWA (Vessel A) Cargo ship DAIEIMARU No. 10 (Vessel B) Collision
	Summary	Vessel A was navigating toward Matsuyama Port, Matsuyama City, Ehime Prefecture, and Vessel B was navigating toward Kure Port. Both vessels collided with each other in Ondo no Seto
10	Date and location	Vessel type and name, accident type
	July 28, 2018 Sakurajima ferry landing quay in Sakurajima Yokoyamacho, Kagoshima City, Kagoshima Prefecture	Ferry SAKURAJIMA MARU No. 18 Contact with a quay
	Summary	The vessel collided with the Sakurajima ferry landing quay.
11	Date and location	Vessel type and name, accident type
	August 5, 2018 Off the west coast of Hokudan Murotsu Beach, Awaji City, Hyogo Prefecture	Personal watercraft SJK (Vessel A) with a towed floating body Personal watercraft No. 8 (Vessel B) Collision
	Summary	Vessel A, with the driver and another on board, was navigating around, towing a floating body called an 8-seat banana boat with seven passengers on board. At the same time, Vessel B was navigating around, with the driver on board. Vessel B collided with the floating body Vessel A was towing off the west coast of Hokudan Murotsu Beach, Awaji City, Hyogo Prefecture. Of the passengers on board the floating body, one was killed, one was seriously injured, and three were slightly injured. There were scratch marks on the rear-right part of the floating body. The driver of Vessel B was slightly injured. There were cracks on the starboard-rear gunwale.
12	Date and location	Vessel type and name, accident type
	August 17, 2018 The quay of Kasumigaura South Warf No. 26, Yokkaichi Port, Yokkaichi City, Mie Prefecture	Container vessel OOCL NAGOYA Contact with a quay
	Summary	When the vessel, with the master, 23 other crew members, and a harbor pilot on board, was arriving at the quay of Kasumigaura South Warf No. 26, Yokkaichi Port, the bow collided with the quay and a gantry crane there.
13	Date and location	Vessel type and name, accident type
	September 2, 2018 Off the east coast of the Nihonmatsu swimming	Personal watercraft RXT-X260RS Injury of fellow passengers

	area, Nagahama City, Shiga Prefecture (northern Lake Biwa)	
	Summary	The vessel was on the way back, with the driver on board and two fellow passengers in the rear seats. The fellow passengers in the rear seats fell off the stern into the water and were exposed to the jet flow discharged from the jet nozzle at the stern. As a result, they were seriously injured in the uncovered region of the lower body, including rectal injury.
14	Date and location	Vessel type and name, accident type
	September 4, 2018 Kansai International Airport Access Bridge in Senshu Port, Osaka Prefecture	Oil tanker HOUNMARU Contact with a bridge
	Summary	A maritime typhoon warning was set off as Typhoon No. 21 was approaching the Seto Inland Sea, including Osaka Bay. While anchored off the southeast coast of Senshu Port, the vessel, with the master and ten other crew members on board, was struck by strong winds, dragging the anchor pushed by powerful water flow. As a result, the vessel collided with Kansai International Airport Access Bridge (hereinafter, "the Bridge"). The collision caused the vessel to collapse on the deck at the starboard bow and the accommodation area. The collision caused the bending, fracture, and abrasion of the members of the Bridge. Furthermore, the accident caused the collapse of overhead wire poles, the distortion of rails, gas pipe fractures, and others. There were no casualties among the crew members.
15	Date and location	Vessel type and name, accident type
	September18, 2018 Mitsubishi Naoshima wharf, Naoshima Town, Kagawa Prefecture	Cargo ship ERIK Fatality of a crew member
	Summary	While the vessel was moored at the Mitsubishi Naoshima wharf, with the master and 14 crew members on board, 4 crew members were performing the cleaning work of the upper hatch coaming of the cargo holds after unloading cargo, and an able seaman fell from the upper deck to the bottom floor of the cargo hold. The able seaman was pronounced dead after being conveyed from the cargo hold.
16	Date and location	Vessel type and name, accident type
	September 29, 2018 Kanmon Passage	Cargo ship SM3 (Vessel A) Oil tanker KOUTOKUMARU (Vessel B) Collision
	Summary	Vessel A and Vessel B were navigating along the Kanmon Passage and collided with each other.
17	Date and location	Vessel type and name, accident type
	October 1, 2018 Ogishima, Kawasaki City, Kanagawa Prefecture	Cargo ship MARINA Contact with a coast revetment
	Summary	While anchored at an anchorage ground off Daikoku Quay to take shelter from an upcoming typhoon, the vessel dragged its anchor due to strong winds, colliding with a coast revetment in Ogishima.
18	Date and location	Vessel type and name, accident type
	October 4, 2018 Off the north coast of Oshima, Munakata City, Fukuoka Prefecture	Recreational fishing vessel SEIRYOMARU Fatality of a fishing passenger
	Summary	The vessel, with the skipper and four fishing passengers on board, was navigating on the way back to Konominato Fishing Port, Munakata City. One of the fishing passengers fell off the vessel into the water and died.
19	Date and location	Vessel type and name, accident type
	October 22, 2018 Oshima Long Bridge over Obatake Seto between Yanai City and Suo-Oshima Town, Yamaguchi Prefecture	Cargo ship ERNA OLDENDORFF Contact with a bridge

	Summary	The vessel, with the master and 20 other crew members on board, was heading east in Obatake Seto toward a private berth in Etajima City, Hiroshima Prefecture, and collided with Oshima Long Bridge. The collision caused the vessel to collapse on three of the four on-board cranes and bend the mast, but there were no casualties. Oshima Long Bridge had cracks, collapses, and others on the bridge girders. Also, the inspection passage installed on the bridge girders fell off. Furthermore, the water line and others were fractured, resulting in water outage for more than a month in almost the entire area of Suo-Oshima Town, Yamaguchi Prefecture.
20	Date and location	Vessel type and name, accident type
	November 8, 2018 Mizushima West No. 1 Breakwater, Kurashiki City, Okayama Prefecture	Cargo ship JFE VENUS Contact with a breakwater
	Summary	After departing from JFE Takahashi River Product Quay (Mizushima Port), the vessel lost control, colliding with Mizushima West No. 1 Breakwater.
21	Date and location	Vessel type and name, accident type
	December 21, 2018 Approximately 6km off the north coast of Tomogashima, Wakayama City, Wakayama Prefecture	Cargo ship CAPE VERDE (Vessel A) Fishing vessel MUNEYOSHIMARU (Vessel B) Collision
	Summary	Vessel A and Vessel B collided with each other approximately 6km off the north coast of Tomogashima, and Vessel B capsized after the collision. Two crew members onboard Vessel B were rescued (one of the two suffered cardiopulmonary arrest) and were transported to a medical institution.

(Marine incidents)

1	Date and location	Vessel type and name, incident type
	June 30, 2018 Off the north coast of Ainoshima, Shingu Town, Fukuoka Prefecture	Oil tanker TENSHOMARU No. 2 Loss of control (no fuel supply)
	Summary	The vessel, with the master and seven other crew members on board, was heading east-northeast off the north coast of Ainoshima, Shingu Town, Fukuoka Prefecture. The vessel's generator motor stopped operating, and the ship lost its power supply. Because of the inability to operate the main engine, the vessel lost control.
2	Date and location	Vessel type and name, incident type
	July 12, 2018 Takamatsu Port, Takamatsu City, Kagawa Prefecture	Passenger Ferry KONPIRA 2 Loss of control (loss of power)
	Summary	The vessel, with the master, 11 other crew members, 46 passengers, and 49 vehicles on board, was heading north in Takamatsu Port, Takamatsu City, Kagawa Prefecture. The air circuit breaker on the main switchboard was deactivated (opened) to cause a blackout. The main engine stopped, which disabled the breaker from being reactivated (closed). As a result, the vessel lost control. There were no casualties among passengers and crew members. The vessel's hull had no damage.

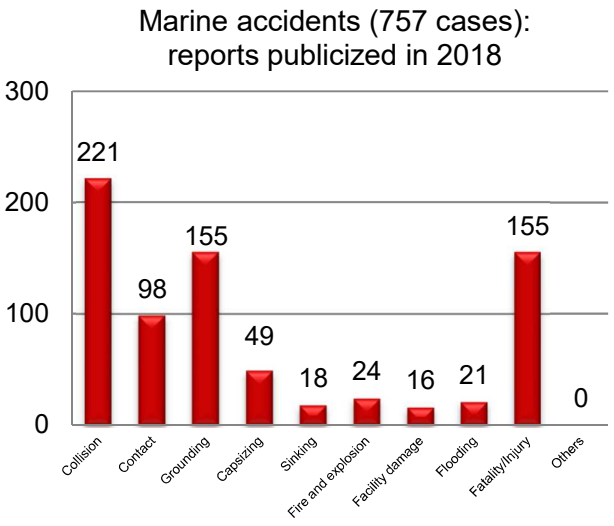
8 Publication of investigation reports

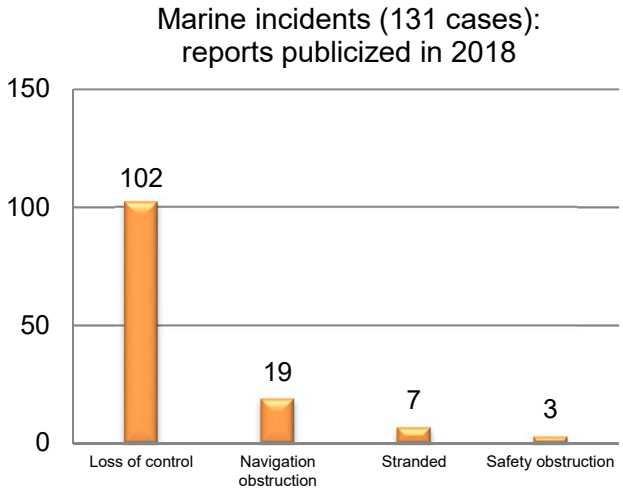
The number of investigation reports of marine accidents and incidents published in 2018 was 888, consisting of 757 marine accidents (among them, 12 were serious) and 131 marine incidents (among them, two were serious).

Breaking them down by type, the marine accidents included 221 cases of collision, 155 cases of grounding, 155 cases of fatality/injury, and 98 cases of contact. The marine incidents included 102 cases of losses of control, (101 cases of navigational equipment failure and one case of listing), 19 cases of

navigation obstruction, seven cases of stranded, and three cases of safety obstruction.

As for the objects of contact, 23 were quays, 21 were breakwaters, and nine were piers.





The number of vessels involved in marine accidents and incidents was 1,025. Breaking them down by type, the marine accidents involved 348 fishing vessels, 226 pleasure boats, 155 cargo ships, 52 passenger ships and 52 tankers. The marine incidents involved 50 fishing vessels, 32 pleasure boats, 19 cargo ships, and 12 passenger ships.

Number of vessels by type involved in marine accidents and incidents for which reports were publicized in 2018

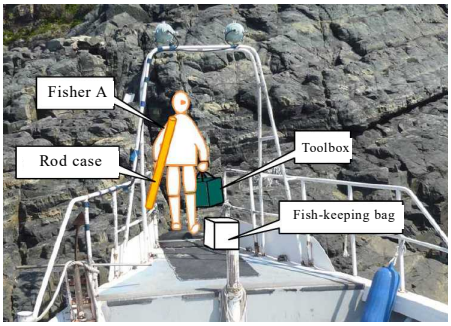
(Vessel)

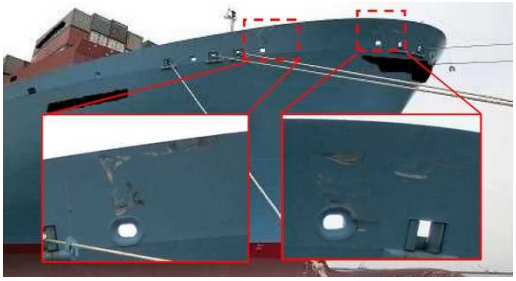
Classification	Passenger ship	Cargo ship	Tanker	Fishing vessel	Tug boat, push boat	Recreational fishing vessel	Fishing ferry	Work vessel	Barge, lighter	Public-service ship	Pleasure boat	Personal water craft	Others	Total
Marine accident	52	155	52	348	42	39	3	23	31	7	226	43	4	1,025
Marine incident	12	19	8	50	3	1	0	1	2	2	32	0	3	133
Total	64	174	60	398	45	40	3	24	33	9	258	43	7	1,158
%	5.5	15.0	5.2	34.4	3.9	3.4	0.3	2.1	2.8	0.8	22.3	3.7	0.6	100.0

The marine accidents and serious incidents which occurred in 2018 are summarized as follows:

Marine serious accident reports published in 2018

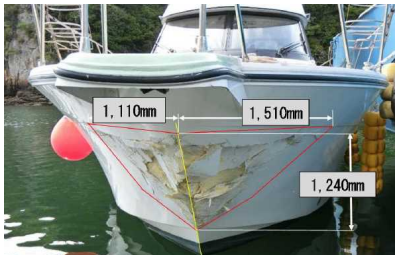
<table>
<tr><td rowspan="4">1</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>January 25, 2018</td><td>August 1, 2016
Off the south coast of Hiroshima, Marugame City, Kagawa Prefecture</td><td>Passenger ferry – Ferry KITAKYUSHU II (Vessel A)
LPG tanker KASHIMA MARU No. 5 (Vessel B)
Collision</td></tr>
<tr><td>Summary</td><td colspan="2">Vessel A, with the master, 26 other crew members, 566 passengers, and 92 vehicles on board, was heading west along the Bisan Seto North Traffic Route toward Kanmon Port Shinmoji District. At the same time, Vessel B, with the master, six other crew members, and 500t of liquefied propylene on board, was heading west along the same traffic route toward Niihama Port, Niihama City, Ehime Prefecture. Off the south coast of Hiroshima, Marugame City, Kagawa Prefecture, the two vessels collided.
Vessel A suffered collapses and abrasions on the outer plate at the portside stern, and Vessel B received collapses and bending at the portside bridge wing and the portside rear. There were no casualties on either vessel.</td></tr>
<tr><td>Probable Causes</td><td colspan="2">To prevent a collision with passenger ferry TSUKUSHI navigating ahead along the North Traffic Route off the south coast of Hiroshima at night, Vessel A stopped with its bow facing south near the southern borderline of the North Traffic Route. Vessel A went astern to return to the North Traffic Route and improve its position, but the master and officer did not appropriately watch the following Vessel B. Vessel A kept moving backward toward the course of Vessel B. Additionally, Vessel B's officer did not appropriately watch Vessel A, either, and the officer was late to notice that Vessel A was moving backward to the course of Vessel B. It is probable that the two vessels collided with each other in this way.
 
It is probable that the reasons why the master and the officer of Vessel A did not appropriately watch Vessel B behind it included the following. Vessel A told Vessel B to the effect that Vessel A wanted Vessel B to pass on the starboard side of Vessel A. The officer of Vessel B responded that he/she acknowledged the request. Vessel A assumed that Vessel B would pass on the starboard side of Vessel A.
It is probable that the reasons why the officer of Vessel B did not appropriately watch Vessel A included the following. The officer thought Vessel A would resume navigation by the time Vessel B approached Vessel A. Vessel A did not tell this to the officer of Vessel B that it was going astern. There was no whistle signal warning that Vessel A had put the main engine astern.
It is somewhat likely that the reasons why Vessel A did not tell Vessel B included the master of Vessel A being preoccupied with returning to the North Traffic Route and improving its position and the officer became upset and disordered.
It is probable that the reason why Vessel A stopped near the southern borderline of the North Traffic Route with its bow facing south was that Vessel A did not keep a sufficient amount of distance between passenger ferry TSUKUSHI that was navigating ahead of Vessel A.</td></tr>
<tr><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-1-1_2016tk0010.pdf</td></tr>
<tr><td rowspan="2">2</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>February 22, 2018</td><td>December 29, 2016
Near the northwest coast of Futaoijima island, Shimonoseki City, Yamaguchi Prefecture</td><td>Fishing ferry KASUGAMARU
Fatality of a fishing passenger</td></tr>
</table>

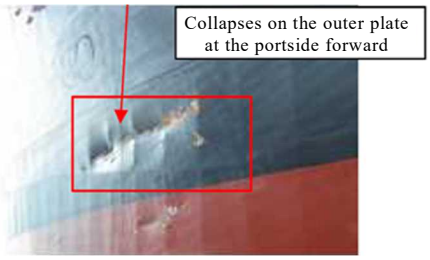
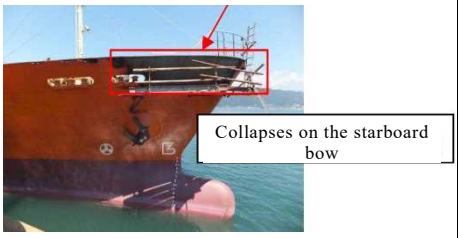
	Summary	The vessel, with the skipper on board, was accommodating fishing passengers (fishers) on rocky ground near the northwest coast of Futaoijima island, Shimonoseki City, Yamaguchi Prefecture (called San no Hana). A fisher tried to transfer from the rocky ground to the vessel's bow, but fell into the water and died. 
	Probable Causes	It is somewhat likely that this accident occurred as follows. Near the northwest coast of Futaoijima island, the vessel was accommodating a fisher by pressing the vessel's bowhead against San no Hana. The fisher tried to transfer from San no Hana to the vessel and stepped on the tire mounted to the bowhead. At that moment, the vessel received a wave with a height over about 3m from the port side, which moved the hull to the starboard side. The fisher lost his balance and slipped from the position where he started his transfer down to a dip and then fell into the water. It is somewhat likely that the reasons why the vessel received that high wave from the port side were as follows. The skipper was late to notice that wind speeds and wave heights in the vicinity of San no Hana exceeded the vessel return standards, and the skipper was accommodating the fisher under conditions exceeding the standards. It is probable that the reason why the skipper was late to notice that wind speeds and wave heights in the vicinity of San no Hana exceeded the vessel return standards was that he neither stood by in the Futaoijima island fishing port nor patrol around the rocky ground. Regarding the fact that the fisher ended up losing his balance, slipping from the position where he started his transfer down to a dip, and falling into the water, it probably had something to do with the fisher transferring from San no Hana to KASUGAMARU, with his luggage in both hands. It is somewhat likely that the inability of the vessel to rescue the fisher in the water had something to do with the following. (1) The vessel, usually only with the skipper on board, had no one else who could help rescue the fisher. (2) Because the vessel was in shallow water near San no Hana and there were higher-than-3m waves, the skipper had to rescue the fisher who fell in the water while maneuvering the vessel to prevent it from running ashore. (3) Because the fisher had his luggage in both hands even after falling into the water, he could not hold the lifebuoy the skipper threw to him tightly. (4) Because the vessel was not equipped with a ladder, the skipper could not rescue the fisher on board using a ladder. It is somewhat likely that the death of the fisher was attributable to the following. (1) When falling in the water at an air temperature of about 7C° and a water temperature of about 16°C, the fisher left the lifebuoy several times, resulting in exhaustion and a decrease in body temperature. (2) It is probable that because the floating vest the fisher wore had sufficient buoyancy, he was floating in a backward inclining position with his face above the seawater after falling in the water. However, because he was drifting against higher-than-3m waves and rough return waves in the shallow water, he was prone to taking in seawater.
	Report	http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-2-1_2017tk0001.pdf
3	Date of Publication	Date and location / Vessel type and name, accident type
	February 22, 2018	June 7, 2016 Kobe Chuo Passage, Kobe Section, Hanshin Port Container Ship ESTELLE MAERSK (Vessel A, Denmark) Container Ship JJ SKY (Vessel B, Hong Kong) Collision
	Summary	While the Vessel A, with the Master, 27 crew members and a pilot on board, was proceeding north toward the South Entrance of Kobe Chuo Passage in the Kobe Section of Hanshin Port

		under escort by the pilot, and the Vessel B, with the Master and 21 crew members on board, was proceeding west-northwest toward the South Entrance of Kobe Chuo Passage, the two vessels collided near the South Entrance of Kobe Chuo Passage. The Vessel A sustained abrasion damage on the shell plating of her starboard bow, while the Vessel B sustained a pressure collapse on part of her bridge port-side wing. However, there were no casualties or fatalities on either vessel.
	Probable Causes	It is probable that this accident occurred because, while the Vessel A was proceeding north and the Vessel B west-northwest toward the Passage in the Kobe Section of Hanshin Port in a state whereby they would both enter the Passage at about the same time, Pilot of Vessel A thought that Vessel A would be given priority when entering the Passage and thus continued to proceed north toward the South Entrance of the Passage, while Master of the Vessel B, thinking that Vessel A would navigate astern of Vessel B, increased speed in an attitude of cutting diagonally across the Passage toward the scheduled docking quay to the west of the Passage, as a result of which the two vessels collided.  It is probable that Pilot thought that Vessel A would be given priority when entering the Passage and continued to proceed north toward the South Entrance of the Passage because (1) Vessel A was a large vessel in the 400m class and he thought that it would be given priority to enter the Passage by passage control, (2) he had made a request for the order of Passage entry, via Port Radio, to the effect that he wished to enter ahead of the vessel navigating from the Osaka (hereinafter referred to as "Vessel D"), Vessel D had accepted this and set an attitude of entering the Passage after Vessel A, and (3) Vessel A was navigating in accordance with the scheduled Passage entry time notified to Port Radio. It is probable that Master of Vessel B thought that Vessel A would navigate astern of Vessel B and increased speed in an attitude of cutting diagonally across the Passage toward the scheduled docking quay to the west of the Passage because (1) he had heard the communication "Follow Vessel B" between other vessels on VHF, (2) the distance to Vessel C which was navigating ahead of Vessel B was about 0.3M, and he therefore thought that it would be dangerous for Vessel A to pass between Vessel B and Vessel C, and (3) he confirmed the presence of Vessel A by radar and thought that Vessel A would be in an attitude of navigating astern of Vessel B as long as Vessel A did not change course.  It is probable that the fact that Vessel A and Vessel B were not communicating by VHF when they were in a state of entering the Passage at about the same time contributed to the occurrence of this accident.
	Report	http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2016tk0008e.pdf See Page 49 of "Feature 2: Summaries of Major Marine Accident Investigation Reports (case studies)"

4	Date of Publication	Date and location	Vessel type and name, accident type
	February 22, 2018	August 7, 2016 Off to the Southeast of Higashi-Ogishima Island, Kawasaki City, Kanagawa Prefecture	Chemical Tanker EASTERN PHOENIX (Vessel A, Panama) Oil Tanker KEIHIN MARU No. 8 (Vessel B) Collision

<table>
<tr><td></td><td>Summary</td><td colspan="2">The Vessel A was proceeding south-southwest toward Uraga Channel after leaving the Kawasaki Passage of the Kawasaki Section of Keihin Port with a master and 14 crew members onboard and the Vessel B was proceeding west-southwest toward the Yokohama Section of Keihin Port with a master and two crew members onboard when the two vessels collided off to the southeast of Higashi-Ogishima Island in Kawasaki City, Kanagawa Prefecture.
The Vessel A had a dent and other damage to her bow's shell plating and the Vessel B had a hole and other damage on her port bow that resulted in a spill of light oil she was carrying as cargo onto the ocean's surface.
There were no fatalities or injuries on either vessel.</td></tr>
<tr><td></td><td>Probable Causes</td><td colspan="2">It is probable that the accident occurred when, as the Vessel A was proceeding south-southwest and the Vessel B was proceeding west-southwest off to the southeast of Higashi-Ogishima Island, both vessels collided because, despite turning and other maneuvers to avoid a collision by both vessels, Vessel A's Master was not properly conducting lookout of the surroundings and Vessel B was late in taking action to avoid a collision.
 
It is probable that Vessel A's Master was not properly conducting lookout of the surroundings because he was giving continuous instruction concerning position reports and other matters to Vessel A's Navigation Officer and Able Seaman.
It is probable that Vessel B was late in taking action to avoid a collision because, although Vessel B's Master judged that there was a risk of collision with Vessel A and ordered Vessel B's Navigation Officer, who was steering, to take avoiding action, Vessel B's Navigation Officer preferred his own judgment and continued navigating by maintaining course and speed.
It is somewhat likely that Vessel B's Navigation Officer preferred his own judgment in part because it appeared to him that Vessel A's bearing was moving toward Vessel B's stern and because he normally had a weak awareness of his hierarchal relationship with Vessel B's Master.
  </td></tr>
<tr><td></td><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2016tk0011e.pdf</td></tr>
<tr><td>5</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td></td><td>July 26, 2018</td><td>May 14, 2017
Kuroshima Fishing Port, Sasebo City, Nagasaki Prefecture</td><td>Water taxi SAKURA
Contact with a breakwater</td></tr>
<tr><td></td><td>Summary</td><td colspan="2">The vessel, with the skipper and 11 passengers on board, was departing from a pier at Kuroshima Fishing Port, Sasebo City, for Ainoura Port in the same city of Nagasaki Prefecture. The vessel collided with the offshore breakwater in Kuroshima Fishing Port. Two passengers on board the vessel were severely injured, and five suffered minor injuries. The collision caused the outer plate at the bow to collapse and fracture.</td></tr>
</table>

	Probable Causes	This accident occurred when the vessel was departing from Kuroshima Fishing Port at night. The vessel turned left at a point about 10m east of the simple beacon red light on the head of the outer breakwater to pass the offshore breakwater, with the simple beacon light at the west end of the outer breakwater seen on the starboard side. At that time, the skipper was watching only visually without monitoring the screens of the radar and GPS plotter. As a result, the skipper could not confirm the location of the offshore breakwater. The skipper also believed one of the fishing lights seen off the starboard bow to be the simple beacon light on the west end of the offshore breakwater. It is probable that the skipper misidentified the ship position and continued navigation believing the vessel was keeping a course passing west of the offshore breakwater. As a result, the vessel collided with the offshore breakwater. It is probable that the reason why the skipper was watching only visually was that he thought watching only visually without monitoring the screens of the radar and GPS plotter would be better in promptly responding to other vessel movements in a narrow path such as in a port.
		
	Report	http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-7-1_2017tk0008.pdf

6	Date of Publication	Date and location	Vessel type and name, accident type
	August 30, 2018	August 7, 2017 Outside of Takuma Port, Mitoyo City, Kagawa Prefecture (the area outside of the port boundary)	Cargo ship ASIAN BEAUTY (Vessel A, Panama) Liquefied gas bulk carrier ZEUS (Vessel B) Collision
	Summary	While anchored with a single anchor, the Vessel A, which had a master and 20 crewmembers on board, dragged anchor. Although the anchor was heaved up and let go again, the Vessel A could not be helped from becoming un-maneuverable. the Vessel A drifted in the current, and suffered a dent, etc. to her front port, and the Vessel B suffered a dent, etc. on her starboardside bow. There were no injuries or fatalities for either ship.	
	Probable Causes	It is probable that, when the storm warning was issued in SETO NAI KAI, including off the north coast of Shikoku, due to incoming Typhoon 5, the Vessel A dragged anchor while it was anchored with a single anchor, waiting at Takuma Port for its cargo. Master of the Vessel A, instead of evacuating to a safe area, heaved up the anchor and returned to the anchoring area at 275o of and about 1,500m from the Mitamaiwa light beacon, which was directed by an agency of the Vessel A, to reset the anchor, but that didn't work. While the anchor was lifted, the Vessel A became un-maneuverable and drifted; as a result, it collided with the the Vessel B. It was probable that Master of the Vessel A returned to the position 275° of and about 1,500m from the Mitamaiwa light beacon, which was directed by an agency of the Vessel A, to retry anchoring instead of evacuating to a safe area because he didn't understand anchoring, by itself, would not provide a sufficient escape from the adverse weather. It was probable that the Vessel A dragged anchor because, even though Master of the Vessel A received information about the predicted stormy weather due to incoming Typhoon 5, he didn't know the required length of anchor chain extension nor measures against strong wind and continued to be anchored with single anchor. In the area crowded with many other anchored ships, Master of the Vessel A had retried to anchor the Vessel A, but he was unsuccessful. So, he used the engine from dead slow ahead to slow ahead, in a low load operation. It is probable that as a result, the Vessel A lost control of its attitude and became un-maneuverable.
			
			

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<tr><td></td><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2018tk0006e.pdf</td></tr>
<tr><td rowspan="3">7</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>September 27, 2018</td><td>July 31, 2015
Off the south coast of Tomakomai Port, Tomakomai City, Hokkaido</td><td>Passenger ferry SUN FLOWER DAISETSU
Fire</td></tr>
<tr><td>Summary</td><td colspan="2">The vessel, with the master and 22 other crew members, 71 passengers, and 160 vehicles on board, departed Oarai Port, Oarai Town, Ibaraki Prefecture, for Tomakomai Port, Tomakomai City, Hokkaido. When heading north off the south coast of Tomakomai Port, the vessel had a fire break out on the second deck.
On the vessel, despite the effort of crew members in extinguishing the fire, it spread to the extent that the master had to order to abandon ship. Other passenger ferries that came to the rescue of the vessel rescued all the passengers and crew members except the second officer. The second officer was missing. But he was found on the second deck on August 3, confirmed dead.
The vessel was then towed to Hakodate Port, Hakodate City, Hokkaido, where carbon dioxide was injected into the vessel to extinguish the fire. Full fire extinguishment was confirmed on August 10.
The fire burned out the vessel’s decks and hull structures such as the outer plate on the second through fourth decks at the center of the starboard side, as well as the vehicles and other goods loaded on the second and third decks.</td></tr>
<tr><td>Probable Causes</td><td colspan="2">When the vessel was heading north for Tomakomai Port off the south coast, this marine accident occurred due to a fire that broke out from the in-vehicle refrigerator unit of a truck loaded at the center of the starboard side on the second deck. It is somewhat likely that this accident occurred because the crew members did not conduct fire extinguishment and prevention of fire spreading appropriately.
 
The ceiling of the starboard center
 
The ceiling of the starboard center
 
Outer plate at the starboard center (seen from the vessel inside)
 
Outer plate at the starboard center
Concerning the fire from an in-vehicle refrigerator unit, it is somewhat likely that an electric fault occurred at a point where wire connection was made by a method not permitted by the maker's service manual. Still, the cause of the fire was not identified.
When finding the fire, the crew members could not appropriately extinguish the fire using fire extinguishers. It is somewhat likely that because the fire source was inside the cover of the in-vehicle refrigerator unit, they could not discharge extinguishing agents effectively at the fire source.
It is somewhat likely that the reasons why the crew members were unable to extinguish the fire and prevent fire spreading by discharging water from fire-fighting hoses included the following. (1) They did not conduct a systematic fire-fighting operation by wearing firefighting outfits. (2) The crew members did not know how to use the stationary pressure water-spraying unit well, and they sprayed water into five sections, which was beyond the capability of the pump. (3) Furthermore, they did not secure the additional space needed for a safe and appropriate fire-fighting operations.
It is somewhat likely that the reason why the crew members could not appropriately extinguish the fire and prevent fire spreading was the lack of practical education and training by MOL Ferry Co., Ltd. for its crew members.
The second officer died due to this fire accident. It is probable that he walked into the downwind side and inhaled carbon monoxide while fulfilling his responsibilities at the dangerous fire site, such as looking for missing deckhands.
It is somewhat likely that if MOL Ferry Co., Ltd. had provided education on the danger of toxic gases in the event of a fire, the second officer could have understood the dangerous situation better.</td></tr>
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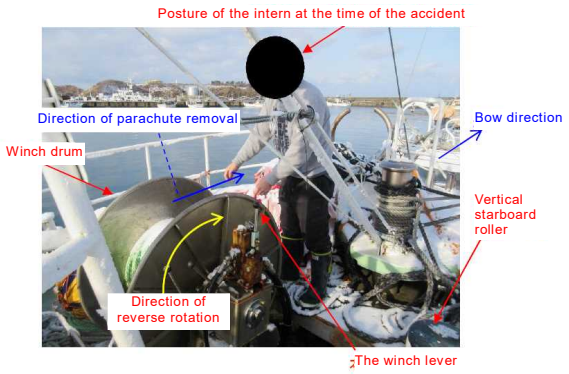
<tr><td></td><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-9-1_2015tk0005.pdf
http://www.mlit.go.jp/jtsb/ship/p-pdf/MA2018-9-1-p.pdf (presentation material)
See Page 48 of “Feature 2: Summaries of Major Marine Accident Investigation Reports (case studies)”</td></tr>
<tr><td rowspan="4">8</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>October 25, 2018</td><td>April 24, 2017
Berth No. 16, Hakozaki Wharf, Hakata Port, Fukuoka City, Fukuoka Prefecture</td><td>Cargo Ship TAI YUAN (Belize)
Fire</td></tr>
<tr><td>Summary</td><td colspan="2">The Vessel, with a master and ten other crew members aboard, was waiting to begin loading of waste metal and other miscellaneous scrap at the No. 16 Berth of Hakozaki Wharf, Hakata Port, Fukuoka City, Fukuoka Prefecture, a fire broke out in the aft cargo hold.
On the following day, April 25, the ship foundered during firefighting and became a total loss. An oil spill occurred, but there were no fatalities or injuries.</td></tr>
<tr><td>Probable Causes</td><td colspan="2">It is probable that the accident occurred when, as the Vessel was moored for the purpose of cargo-handling at Hakata Port, a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using the Vessel’s carbon dioxide gas firefighting equipment were not employed.
 
It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment.
It is probable that the Master did not think of using the carbon dioxide gas firefighting equipment because he did not have experience with fire drills for a fire in the Vessel’s cargo holds and because the Vessel and Company A did not share information on effective firefighting methods for times of fire. It is somewhat likely that firefighting by water-spraying was not effective because the sprayed water was blocked by the scrap’s surface layer and did not reach the fire’s origin.
Regarding the fire that broke out inside the scrap, it is somewhat likely that a spark created by contact between metal objects, a battery, etc., was the source of the fire, and that the source ignited combustible material. However, it was not possible to determine the circumstances leading up to the fire.</td></tr>
<tr><td></td><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2017tk0007e.pdf
See Page 51 of “Feature 2: Summaries of Major Marine Accident Investigation Reports (case studies)”</td></tr>
<tr><td rowspan="4">9</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>October 25, 2018</td><td>February 11, 2017
On the southwest coast of the Suwanosejima Island, Toshima-mura, Kagoshima Prefecture</td><td>Oil Tanker SAGAN (Panama)
Grounding</td></tr>
<tr><td>Summary</td><td colspan="2">The Vessel, with 18 crews, including the master, became unable to start and drifted due to failures in the main engine while heading northeast off the western coast of the Noma Peninsula, Satsuma-shi, Kagoshima Prefecture. She grounded on the southwest coast of the Suwanosejima Island, Toshima-mura, Kagoshima Prefecture.
 
The Vessel was completely destroyed with cracks, etc. on the bottom shell, but there were no casualties.</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
</table>

	Probable Causes	It is probable that in the accident, while heading northeast in the East China Sea, the Vessel became unable to operate because the main engine could not be started due to the impossibility of repairing failures and that the Vessel continued drifting and was pushed to flow toward east-southeast by strong wind and waves and grounded. It is probable that the main engine could not be started to start because it became impossible to keep the piston and the cylinder liner airtight due to excessive abrasion and breakage of the piston rings that were in use. It is probable that the Vessel continued drifting because she was not rescued due to heavy weather though the master called Company A and the agency for a rescue when the Vessel approached the site of occurrence of the accident.	
	Report	http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2017tk0006e.pdf	
10	Date of Publication	Date and location	Vessel type and name, accident type
	December 20, 2018	July 26, 2017 Hanshin Port Kobe District 6　Kobe Airport east approach light beacon	Passenger ship SORA Contact with an approach light beacon
	Summary	The vessel, with the master, the chief engineer, and 29 passengers on board, departed from the Kaijo Access Terminal of Senshu Port, heading north for a pier at the Kobe Airport Kaijo Access Terminal in Hanshin Port Kobe District 5. Then the vessel collided with the Kobe Airport east approach light beacon in Hanshin Port Kobe District 6. On the vessel, four passengers were severely injured, and 21 passengers and two crew members suffered minor injuries. The hull suffered collapses and other damage to the portside bow area. The Kobe Airport east approach light beacon suffered abrasions to the support legs. 	
	Probable Causes	It is probable that this accident occurred in the following situation. At night, the beacon of the Kobe Airport east approach light beacon E2 was difficult to see due to the illuminating lights at Port Island's container terminal in the background. The vessel was heading north in Hanshin Port Kobe District for a pier at Kobe Airport Kaijo Access Terminal in Hanshin Port Kobe District 5. The master was watching only visually without monitoring the radar installed on the port side of the steering stand and the GPS plotter with overlaid radar images. The master did not notice that the vessel was heading for the Kobe Airport east approach light beacon, then the ship collided with the beacon. It is probable that the reasons why the master was watching only visually without monitoring the radar installed on the port side of the steering stand and the GPS plotter with overlaid radar images were as follows. (1) The master was chatting with the chief engineer. (2) He had been able to see in the past the light of the Kobe Airport east approach light beacon E2 when approaching the lighthouse. By leaving ship steering to the chief engineer, the master was handling his smartphone. The master kept chatting with the chief engineer, and he was watching only visually without monitoring the radar installed on the port side of the steering stand and the GPS plotter with overlaid radar images. Paying less attention to return the vessel into the reference route, the master navigated the ship on the west side of the reference route without displaying it on the GPS plotter with overlaid radar images. Furthermore, the chief engineer transferred ship steering to the master without sharing information about the light beacon E2, and he was checking records in the engine logbook without watching the bow direction. It is probable that such behavior shows a lack of discipline in the vessel's wheelhouse, which was attributable to the occurrence of this accident. One of the reasons why the discipline in the wheelhouse was not maintained was that OM Kobe Co., Ltd. had not defined and disseminated the specific details of the standard arrangement of mariners on watch duty that the Safety Management Rule requires to be stipulated. At the same time, there was not enough safety education and training to learn the	

<table>
<tr><td></td><td></td><td colspan="2">importance of ship navigation. Those include watching with the help of the radar installed on the port side of the steering stand and the GPS plotter with overlaid radar images, sharing the same information among crew members, and navigating along reference routes as much as possible. Based on this information, it is probable that the safety management of OM Kobe Co., Ltd. was not working effectively, which was attributable to the occurrence of this accident.
There were many injuries, including those who suffered severe injuries. It is probable that many passengers did not wear seat belts.
The collision caused the passengers to be thrown in the bow direction, hitting themselves against the front chairs. It is somewhat likely that the chairs that came off the floor contributed to this magnitude of human damage.</td></tr>
<tr><td></td><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-12-1_2017tk0010.pdf
http://www.mlit.go.jp/jtsb/ship/p-pdf/MA2018-12-1-p.pdf (presentation material)
See Page 52 of “Feature 2: Summaries of Major Marine Accident Investigation Reports (case studies)”</td></tr>
<tr><td rowspan="4">11</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>December 20, 2018</td><td>July 31, 2017
Off the east-northeast coast of Rebun Island, Rebun Town, Hokkaido</td><td>Fishing vessel EIFUKUMARU
Injury of a crew member</td></tr>
<tr><td>Summary</td><td colspan="2">The vessel, with the skipper, deckhands, and a technical intern on board, was fishing for squid off the east-northeast coast of Rebun Island, Rebun Town, Hokkaido. The technical intern was caught in a winch drum and was severely injured.
 
</td></tr>
<tr><td>Probable Causes</td><td colspan="2">This accident occurred when the vessel was lifting a parachute sea anchor at night off the east-northeast coast of Rebun Island. It is probable that the technical intern had his right hand caught between the winch drum and the parachute.
It is somewhat likely that the reason why the technical intern had his right hand caught between the winch drum and the parachute was that he rotated the winch drum rapidly in the winding direction while gripping the parachute with the right hand.
The technical intern had been on board the vessel for about ten days before this accident in which he rotated the winch drum rapidly in the winding direction. The technical intern was unable to communicate well with other people in Japanese, and the skipper was instructing and coaching him in Japanese with gestures. The technical intern was not proficient in the operation to remove the wound parachute from the winch drum. As such, it is somewhat likely that the technical intern was not fully aware of the danger of the operation.
Not knowing the provisions in Article 28 of the Rules for Seafarers Labour Safety and Health, the skipper had the technical intern conduct the operation to remove the wound parachute from the winch drum. It is probable that this situation was attributable to the occurrence of this accident.</td></tr>
<tr><td>Report</td><td colspan="2">http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-12-2_2018tk0011.pdf</td></tr>
<tr><td rowspan="2">12</td><td>Date of Publication</td><td>Date and location</td><td>Vessel type and name, accident type</td></tr>
<tr><td>December 20, 2018</td><td>October 23, 2017
Fushiki-Toyama Port, Toyama Prefecture</td><td>Cargo Ship REAL (Togo)
Grounding</td></tr>
</table>

	Summary	While moored at Public Berth No. 1, Toyama Section, Fushiki-Toyama Port, the Vessel received the effects of wind and waves occurring with the approach of Typhoon No. 21. Her mooring rope broke and she drifted within the port. Subsequently she attempted to proceed toward the port's exterior using her engine, however ship maneuvering became difficult and, she ran aground on tetrapods on the east side of the Toyama West Breakwater on the opposite bank of the berth. The Vessel's engine room and other areas flooded and she became a total loss. However, there were no fatalities or injuries among her crew.
	Probable Causes	 It is probable that, while the Vessel was moored at Public Berth No. 1, near the port's entrance of Toyama Section, Fushiki-Toyama Port at night, under conditions in which Typhoon No. 21 was approaching, she drifted within the port because her mooring ropes broke and subsequently, although she attempted to head outside of the port using her engine, she came under the effects of the wind and waves, ship maneuvering became difficult, and she drifted and ran aground on tetrapods. It is probable that the Vessel's mooring ropes broke because she received the effects of the wind and waves that expedited the hull's motion for the reason that she was using mooring ropes with reduced strength that resulted from fatigue degradation and age degradation, and consequently load that exceeded the strength of the mooring ropes being used was applied to them. It is somewhat likely that, although he added additional mooring ropes, the Master's use of multiple mooring ropes of different diameters together and mooring of the Vessel with ropes made slack contributed to the breaking of the mooring ropes.
	Report	http://www.mlit.go.jp/jtsb/ship/rep-acci/2018/MA2018-12-3_2017tk0013.pdf

Marine serious incident reports published in 2018

1	Date of Publication	Date and location	Vessel type and name, incident type
	January 25, 2018	January 11, 2017 Off the north of Oshima Island, Munakata City, Fukuoka Prefecture	Cargo ship TONG DA (flag state: unknown) Loss of control (hull list)
	Summary	While the Vessel was proceeding east-northeast in Genkai-nada, with a master and 13 other crew members onboard, her hull listed to port and she was intentionally run aground. The Vessel had seawater damage to her engine, cargo, etc. 	
	Probable Causes	It is probable that the incident occurred because, as the Vessel was proceeding east-northeast while being subjected to wind and waves from her port side in Genkai-nada while in a state in which she was listing by approximately 3° after cargo in her No. 2 cargo hold shifted to the port side due to her hull's rolling, seawater that was washing up flooded the No. 2 cargo hold because the weathertightness of the upper deck was not being properly maintained and as a result the Vessel listed approximately 10° to port.	
	Report	http://www.mlit.go.jp/jtsb/eng-mar_report/2018/2017tk0002e.pdf	
2	Date of Publication	Date and location	Vessel type and name, incident type
	May 31, 2018	February 9, 2017 Off the northwest coast of Tatsushima,	Liquefied gas bulk carrier ZUIYOMARU Loss of control (broken intermediate shaft)

		Suo-Oshima Town, Yamaguchi Prefecture	
	Summary	The vessel, with the master and eight other crew members on board, was heading west-southwest for Tokuyama Kudamatsu Port, Yamaguchi Prefecture. Off the east coast of Okikamurojima, Yamaguchi Prefecture, the vessel found the oil box of the controllable pitch propeller swinging and oil leaking from the same place. As an emergency measure, the vessel stopped its main engine and cast anchor in Agenosho Bay, Yashirojima, Yamaguchi Prefecture. The vessel had the intermediate shaft broken. The ship also had one of the four mounting bolts for the oil box of the controllable pitch propeller broken, and the other three bolts were loosened.	
	Probable Causes	 It is probable that the incident occurred in the following situation. The vessel was heading west-southwest at night off the east coast of Okikamurojima for Tokuyama Kudamatsu Port. The vessel had the intermediate shaft broken, and the box of the controllable pitch propeller was swinging, and hydraulic oil was leaking from the box. In Agenosho Bay, where the vessel cast anchor, the vessel lost control as the controllable pitch propeller became uncontrollable. It is probable that the intermediate shaft broke for the following reason. A crack propagated due to vibration, aging, and other reasons from a place that is difficult to check from the outside. The swinging box of the controllable pitch propeller was attributable mainly to the broken intermediate shaft that was swinging. It is somewhat likely that the insufficient strength of mounting bolts and nuts also contributed to this accident.	
	Report	http://www.mlit.go.jp/jtsb/ship/rep-inci/2018/MI2018-5-1_2018tk0001.pdf	

9 Actions taken in response to recommendations and opinions in 2018

Actions taken in response to recommendations were reported with regard to accidents and marine serious incident in 2018. Summaries of these reports are as follows.

(1) Contact of passenger ship BEETLE with marine creature

(Recommendations on July 27, 2017)

The Japan Transport Safety Board investigated an accident in which a passenger ship, BEETLE, collided with a marine creature off the northwest coast of Kamijima, Tsushima City, Nagasaki Prefecture, on January 8, 2016. On July 27, 2017, the JTSB released a report on the investigation and made recommendations to JR Kyushu Jet Ferry Inc. The Board received a report (completion report) on what measures the company had taken, as follows, based on the recommendations.

● Summary of accident

Passenger ship BEETLE, with the master, the first officer and five other crew members, and 184 passengers on board, lifting its hull above the sea level with the help of lift force generated by the hydrofoil wings, was navigating at a ground speed of about 40 knots off the northwest coast of Kamijima, Tsushima City, Nagasaki Prefecture, from Busan Port, South Korea, for Hakata Port, Fukuoka City, Fukuoka Prefecture. Around 09:54 on January 8, 2016, the vessel collided with a marine creature.

On BEETLE, three passengers suffered severe injuries such as lumbar compression fractures, and four passengers were slightly injured. At the same time, two cabin attendants suffered minor injuries. Because the shock absorber unit at the bow was stretched out, the vessel returned to Busan Port in hullborne mode.

● Probable causes

This accident occurred in the waters that JR Kyushu Jet Ferry Inc. set off the northwest coast of Kamijima on January 4, 2016, to instruct the implementation of decelerated navigation as part of the safety measures against collisions with whales and other marine creatures. It is probable that when navigating at its cruising speed (40 knots), BEETLE found a marine creature at an extremely close range and collided with it, even though its course was changed to avoid a collision.

While navigating at cruising speed, BEETLE found the marine creature only at an extremely close range. The master of BEETLE should have instructed cetacean-cautious maneuver or stepped up the level of watching, including decelerated navigation at a speed of 36 to 38 knots, stepped-up watching over marine creatures by four persons of the master, chief engineer, chief officer and first engineer, suspension of wagon sales, seating of cabin attendants, and a cabin announcement asking passengers to wear seat belts. It is somewhat likely that failure to conduct all of these contributed to the occurrence of this accident.

The master of BEETLE did not provide instructions on cetacean-cautious maneuver for the following reasons. (1) JR Kyushu Jet Ferry Inc. did not define and disseminate guidelines for cetacean-cautious maneuver in the Rules for Safety Management. (2) The ferry company told the master the tolerable length of delay time due to the implementation of decelerated navigation. (3) The company did not monitor the status of cetacean-cautious maneuver, either. It is probable that all of these contributed to the occurrence of this accident.

● Recommendations for JR Kyushu Jet Ferry Inc.

BEETLE collided with a marine creature when navigating at its cruising speed in the waters that you set on January 4, 2016, to instruct the implementation of decelerated navigation as part of the safety measures against collisions with whales and other marine creatures. In this accident, it is probable that the passengers who did not wear seat belts appropriately, the passengers who wore seat belts but set up foldable tables, and the cabin attendants who were selling goods on wagons suffered injuries.

It is probable that the following contributed to the occurrence of this accident. (1) You did not define and disseminate in the Rules for Safety Management guidelines for cetacean-cautious maneuver such as decelerated navigation, stepped-up watching over marine creatures, the suspension of wagon sales, and the need for passengers to wear seat belts. (2) You told the master the tolerable length of delay time due to the implementation of decelerated navigation. (3) You did not monitor the status of cetacean-cautious maneuver, either.

To ensure the safety of passenger transportation based on the results of this marine accident investigation, the Japan Transport Safety Board (JTSB) makes the following recommendations to you in accordance with the provisions in Article 27 (1) of the Act for Establishment of the Japan Transport

Safety Board.
At the same time, under Article 27 (2) of this Act and based on these recommendations, the JTSB demands reports from you on the measures you have taken.

Notes

You must take the following measures to ensure the safety of passenger transportation.

(1) You must stipulate the implementation of cetacean-cautious maneuver in the Rules for Safety Management.
(2) You must make sure that your vessels implement cetacean-cautious maneuver in the waters that you set for decelerated navigation.
(3) You must construct a management framework that enables the monitoring of how well your vessels are implementing cetacean-cautious maneuver.
(4) You must improve the conditions in the passenger cabin by applying cushioning material and encouraging the retraction of foldable tables during cetacean-cautious maneuver.

● The measures JR Kyushu Jet Ferry Inc. has taken based on these recommendations (completion report)

Recommendation (1): You must stipulate the implementation of cetacean-cautious maneuver in the Rules for Safety Management.
Completion report:
We added new items to the Rules for Safety Management, including the issuance of the specification for the waters of decelerated navigation and the implementation and watching of cetacean-cautious maneuver. We also added an item concerning cetacean-cautious maneuver to the operational standards and others stipulated in the Rules for Safety Management. We submitted these changes to the Kyushu District Transport Bureau on September 21, 2017. The bureau accepted them.
Change Notification of the Rules for Safety Management (Appendix 1)

Recommendation (2): You must make sure that your vessels implement cetacean-cautious maneuver in the waters that you set for decelerated navigation.
Completion report:
• We will continue to disseminate Whale-Watching Information via e-mail distribution using information sharing terminals. Also, we have decided to distribute the Specification for the Waters of Decelerated Navigation that describes the waters of decelerated navigation, the subject period, and other information to make what each vessel should do more precise.
• According to the Safety Management Manual stipulated in Article 12 (2) of the Enforcement Regulation of the Ship Safety Act, we decided to disseminate the implementation of cetacean-cautious maneuver in the Safety Management Committee, which is held at least twice a year.
Participants in the Safety Management Committee:
Executive Officer (President), Committee Chairperson (Safety Manager), Vice Chairperson (Deputy Safety Manager), Regular Committee Members (Masters, Chief Engineers, and

Maintenance Center Chief), and Special Committee Members (Managing Director and Directors)

Accomplishments:

October 17, 2017

37th Safety Management Committee: Dissemination of Revisions to the Rules for Safety Management associated with the JTSB recommendations

April 5, 2018

38th Safety Management Committee: Dissemination of the thorough implementation of cetacean-cautious maneuver

• When cetacean-cautious maneuver does not seem to be adequately implemented, the navigation manager or the deputy will call or visit the vessel to provide necessary instruction.

Recommendation (3): You must construct a management framework that enables the monitoring of how well your vessels are implementing cetacean-cautious maneuver.

Completion report:

• The operation manager or operation management staff will check the status of each vessel's decelerated navigation based on the information obtained from the Automatic Identification System (AIS) on PC monitors in the office. (Appendix 2)

• In November 2017, we revised the format of the specification for the waters of decelerated navigation (Appendix 3), adding new check columns for the following action items. The master must fill the columns after checking the implementation of each vessel's decelerated navigation. The operation manager or the deputy will check the status of decelerated navigation as needed. 1) Decelerated navigation, 2) stepped-up watching, 3) suspension of wagon sales, and 4) seat belt wearing and the retraction of foldable tables.

Recommendation (4): You must improve the conditions in the passenger cabin by applying cushioning material and encouraging the retraction of foldable tables during cetacean-cautious maneuver.

Completion report:

• In May 2018, we replaced the material of all the upper armrests of the green seats with cushioning material. (Appendix 4)

• Ten minutes before starting decelerated navigation, we ask our passengers to retract foldable tables through a cabin announcement. Additionally, when patrolling the passenger cabin, the first officer or cabin attendants will directly advise the passengers who are using tables to retract them. To encourage our passengers to retract foldable tables, we installed a drink holder in each seat. (Appendix 5)

*The details in our completion reports, including Appendixes in the attachment, are posted on the website of this Board.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-kankoku17re-2_20180626.pdf

(2) Opinions concerning the rescue of fishing passengers of recreational fishing vessels and fishing ferries who fall into the sea

(Opinions made on February 22, 2018)

Please refer to "2. Opinions, Chapter I Summary of Recommendations and Opinions Made in 2018" ((4) in Page 81)

(3) Opinions concerning the prevention of collision accidents involving recreational fishing vessels

(Opinions made on July 24, 2018)

Please refer to "2. Opinions, Chapter I Summary of Recommendations and Opinions Made in 2018" ((5) in Page 86)

10 Provision of factual information in 2018 (marine accidents and incidents)

The JTSB provided factual information on four cases (marine accidents) to relevant administrative organs in 2018. The details are as follows.

(1) Information provided on contact accidents of pleasure boats at night

(Information provided on March 6, 2018)

Based on the marine accident investigation reports the JTSB published, the number of marine accidents involving pleasure boats that occurred between 2012 and 2016 was 956 (excluding personal watercraft as well as mini boats, rubber boats, and the like not subject to vessel inspection).
Of the 956 accidents, the number of the accidents of pleasure boats contacting with structures like rafts and breakwaters (hereinafter, "contact accidents") was 83 over the five years. While this type of accident accounted for 31 cases, or 4.1%, of 749 accidents in the daytime, it accounted for 52 cases, or 25.1%, of 207 accidents at night. This means contact accidents occurred more often at night than in the day by a factor of about 6.1. Therefore, we provided the following information about the status of contact accidents at night to the Ministry of Land, Infrastructure, Transport and Tourism.

1. There were 52 cases of pleasure boat contact accidents at night.
   Those accidents are broken down to 11 cases in 2012, 11 in 2013, ten in 2014, eight in 2015, and 12 in 2016.

2. These accidents occurred most frequently in July and August with 14 cases, followed by six cases in October, five in November, and four in September. Such accidents occurred more often in the summer, but did occur throughout the year.
   Concerning the time window of the day, these accidents occurred most often during 20:00–21:00 in 11 cases, followed by 21:00–22:00 in ten cases, and 22:00–23:00 in nine cases. There were 30 cases between 20:00 and 23:00, accounting for more than half the total.
3. The structures against which these pleasure boats collided were oyster and farming rafts in 18 cases, breakwaters, tide embankments, and detached breakwaters in 16 cases, piers and seawalls in five cases, and light buoys and beacon lights in three cases.
4. Many people were killed or injured in 28 accident cases of the 52. Two were killed and 87 suffered injuries. Of those who were injured, 29 suffered severe injuries.
   The two died of cardiac rupture, multiple rib fractures, and wound shock.
5. Of the 27 pleasure boats whose purpose of navigation was known, 15 boats went to view fireworks, and 12 for fishing.
6. Of the 32 pleasure boats whose destination was known, 24 boats were on the way back to a port, and eight were departing from a port. The number of boats on the way back to a port after viewing fireworks was 12.
7. Of the 32 boats whose speed at the time of the accident was known, 18 boats were navigating at a speed of 10 knots to less than 20 knots, ten boats less than 10 knots, and four at 20 knots or more.
8. Of the 47 boats whose number of passengers on board was known, 11 boats had three passengers, ten boats had two passengers, six boats had four passengers, and so on. Four boats had ten or more passengers on board.
   The boats whose purpose of navigation was viewing fireworks had about 6.7 passengers per ship on board.
9. Of the 29 skippers whose age was known, 13 were in their 50s, six in their 40s, four each in their 30s and 60s, and two in their 70s.
10. Of the 29 skippers whose service year from the license registration to the time of the accident was known, nine skippers served for five years to less than ten years, five skippers for less than five years, four skippers each for ten to less than 15 years, 15 years to less than 20 years, and 30 years or more, and three skippers for 20 years to less than 30 years.
    Of the five skippers who served for less than five years, three had served for one to two months after their license registration.
    The number of skippers who navigated their boat drunk was two.
    The number of skippers who navigated their boat with the license expired was two.

11. The leading factors that led to accidents were as follows.
    (1) Beacon lights
        1) Misreading a beacon light
        2) Unable to understand the characteristics of a lighthouse

3) The beacon light of a lighthouse overlapping with a beacon light
4) Unable to check the beacon lights of oyster rafts due to the lights of a town and moonlight reflecting on the sea surface.

(2) GPS plotters
1) Not knowing how to adjust the brightness of the screen
2) Turning OFF the power because the screen was too bright.
3) Not magnifying the screen.
4) Believing that navigating along a route recorded in the past would work.
5) Handling the boat while inputting the route on the way back.
6) The breakwater not being displayed on the screen because the data was not updated.
7) Watching visually without using the GPS plotter.

(3) Others
1) It was the first navigation at night.
2) There were no navigation lights on the vessel.

12. The following are leading measures for preventing a recurrence of these problems described in the investigation reports.
(1) Check the boat position not only by watching visually but also utilizing a GPS plotter.
If you do not understand the port conditions, stop the boat to check everything is alright.
(2) Even if you are navigating in waters you are familiar with, use a GPS plotter and other devices.
(3) When using a GPS plotter, make sure to update the data, master how to use it, and change the scale of the display as needed.
(4) When navigating near an obstacle, look for the scheduled navigation route (barriers and beacon lights) and specify reliable head marks and clearing lines in advance.

*Publication of this information is detailed on the website of this Board.
http://www.mlit.go.jp/jtsb/iken-teikyo/s-teikyo11_20180306.pdf

(2) Information provided on accidents of small fishing vessels

(Information provided on March 6, 2018)

Based on the marine accident investigation reports JTSB published, JTSB analyzed the status of the accidents of small fishing vessels that occurred between 2012 and 2016 as follows. JTSB provided the information to the Japan Fishing Vessel Insurance Association.

1. Accidents in which the fisher fell in the water off a single-handed fishing vessel with a gross tonnage of less than 5 tons
(1) There were 96 cases involving 96 vessels during the period. Those accidents are broken

down to 15 cases in 2012, 26 cases in 2013, 23 cases in 2014, 21 cases in 2015, and 11 cases in 2016.

(2) These accidents occurred most frequently in February at 15 cases, followed by 12 cases in January, and ten cases each in April, October, and December.

(3) A total of 76 fishers were killed in 96 cases. The death of five was acknowledged after they were missing, and 15 were still missing. Of the 76 casualties, 68 died of drowning, two of suffocation, one of hemorrhaging of the brain, one of cervical spine fracture and head bruising, and four died of unknown reasons.

(4) The following are the vessel operators whose status was known.

1) Of the 96 vessel operators, 40 operators are in their 70s, 30 in their 60s, 17 in their 80s, seven in their 50s, and so on. There were 70 elderly adults (aged 65 or older).

2) One vessel operator was navigating a small vessel, with his license expired.

3) One vessel operator was unqualified.

4) Of the 95 skippers whose service year from the license registration to the time of the accident was known, 70 skippers served for 30 years to less than 40 years, ten for 20 years to less than 30 years, and eight for 40 years or more, and so on.

(5) Of the 78 vessel operators whose status of wearing a life jacket was known when found, 21 wore a jacket, and 57 did not.

(6) The following are the leading measures for preventing the recurrence of accidents in which fishers fell in the water off the vessel, and which the investigation reports described.

1) Wear a life jacket correctly.

2) Always carry a waterproof mobile phone (or a mobile phone in a waterproof pack) as a communication means for when you fall in the water.

3) If your vessel's performance is not high enough to navigate safely on the day, put off going fishing.

4) Install a portable emergency communication device to your vessel.

5) Install an emergency engine stop device or the like to your vessel.

2. Accidents in which a vessel operator drowsily navigated a fishing vessel with a gross tonnage of less than 20 tons

(1) There were 137 cases involving 137 vessels during the period. Those accidents are broken down to 24 cases in 2012, 32 cases in 2013, 25 cases in 2014, 36 cases in 2015, and 20 cases in 2016.

(2) Of the 137 accidents, 65 cases were stranding, 39 were collisions between vessels, 28 were collisions against seawalls, and five were accidents that damaged facilities.

(3) These accidents occurred most frequently in May at 19 cases, followed by 15 cases in June, 14 cases in December, and 13 cases in September, and so on.

(4) Concerning the time window of the day, these accidents occurred most often at 04:00–05:00 at 15 cases, followed by 05:00–06:00 and 06:00–07:00 each at 14 cases, and

03:00–04:00 at 13 cases.

(5) Of the accidents whose status of navigation was known, 68 accidents occurred when the vessels were on the way back to the port, and 20 accidents happened when the ships were departing from the port.

(6) Of the vessels whose status of navigation was known, 115 vessels were on autopilot, and 15 vessels were on manual steering.

(7) Of the accidents in which an operator drowsily navigated a vessel, 63 cases occurred when returning to the port on autopilot.

(8) The following are the vessel operators whose status was known.

1) Of the 129 vessels whose status was known, all vessel operators were on watch duty alone.
2) Of the 129 vessel operators, 18 operators were in their 50s, 16 in their 30s, 16 in their 60s, 11 in their 40s, and so on.
3) One hundred twenty operators were navigating their vessels sitting on a chair or the like. Six operators were lying on the floor and the like. Four were standing, and two were leaning against a wall or chair.
4) One vessel operator was navigating the vessel, with his license expired.
5) Seven vessel operators were unqualified.

(9) The following are significant factors that led to accidents in which an operator drowsily navigated the vessel.

1) Due to continuous operations, the operator felt tired and had a lack of sleep.
2) The operator was working in the same posture, such as sitting on a chair.
3) Because there were no vessels around, the operator felt relaxed.
4) When the vessel approached its destination, the operator felt relaxed.
5) When the vessel came close to the port, the operator thought he would be able to fight off the urge to sleep.
6) The operator was not in good health and was taking medicine.

(10) The following are the leading measures for preventing the recurrence of accidents in which an operator drowsily navigates the vessel, and which the investigation reports described.

1) Stand away from the chair and always move your body.
2) Breathe in fresh air.
3) Get some rest.
4) Drink coffee and chew a stick of gum.
5) Use a proximity warning device such as radar.
6) Install a bridge navigational watch alarm system.
7) If there are multiple crew members on board, more than one should be on watch duty or change the task in turn.

*Publication of this information is detailed on the website of this Board.

http://www.mlit.go.jp/jtsb/iken-teikyo/s-teikyo12_20180306.pdf

(3) Information provided on anchor dragging accidents and incidents

(Information provided on August 28, 2018)

The above information was distributed to the following entities.

Distribution list

Safety Policy Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism

Navigation Safety Division, Maritime Traffic Department, Japan Coast Guard

Japanese Shipowners' Association

Japan Passengerboat Association

Japan Long Course Ferry Service Association

Japan Federation of Coastal Shipping Associations

Japan Federation of Pilots' Associations

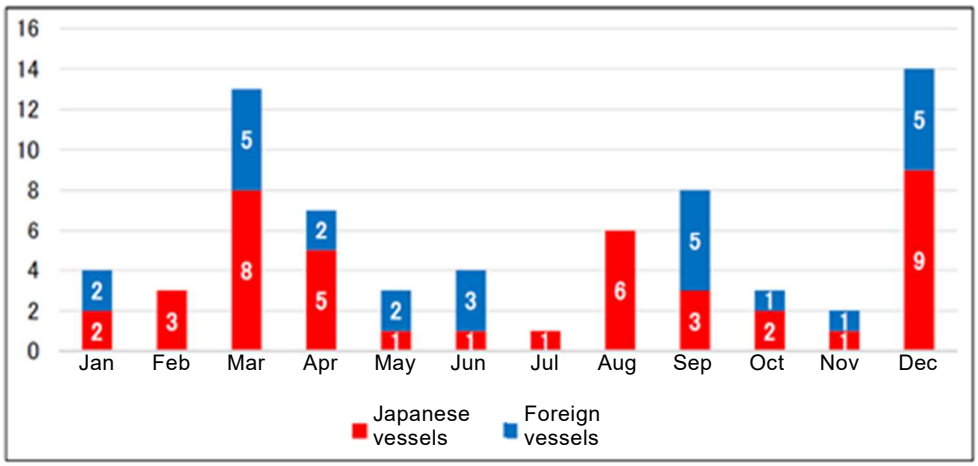
Japan Foreign Steamship Association

Japan Association of Foreign-trade Ship Agencies

Based on the investigation reports that JTSB published from October 2008 to July 2018, the status of the 68 vessels (42 Japanese and 26 foreign) with a gross tonnage of 100 tons or more (excluding pontoons and barges) that experienced anchor dragging accidents and incidents was analyzed as follows.

1. Occurrence of anchor dragging accidents and incidents

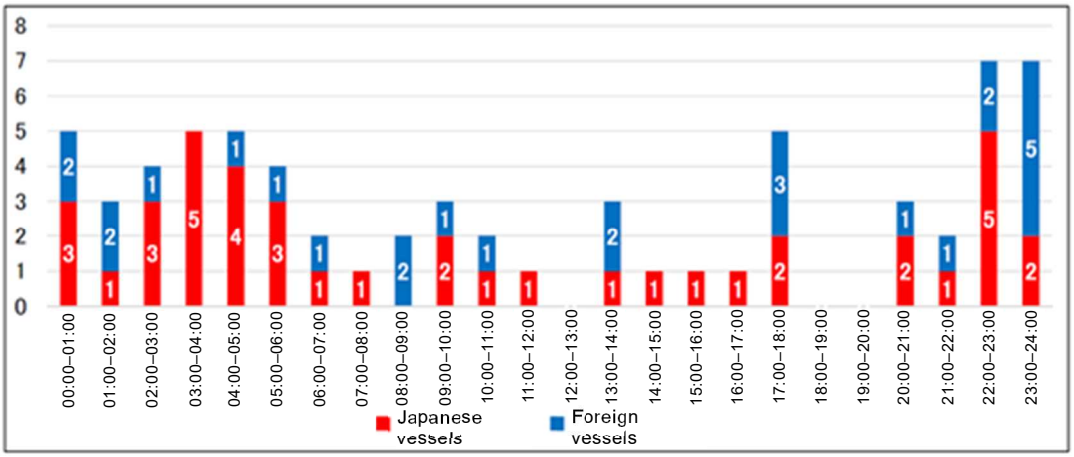
(1) These accidents and incidents occurred often in March at 13 cases, in August and September each at 15 cases, and in December at 14 cases. In many cases, typhoons caused the accidents and incidents in August and September, and the passage of low-pressure systems explained the accidents and incidents in March and December.



(2) Concerning the time window of the day, these accidents and incidents often occurred during the night and early in the morning from 22:00–23:00 to 05:00–06:00. Of the 19 Japanese vessels whose accidents and incidents occurred from 00:00–01:00 to 05:00–06:00, 15 vessels did not set anchor watch.

The status of the setting of anchor watch was known in about 52 vessels of the 68. Of the 30 Japanese vessels, seven set anchor watch and 23 did not. All the 22 foreign ships set anchor watch.

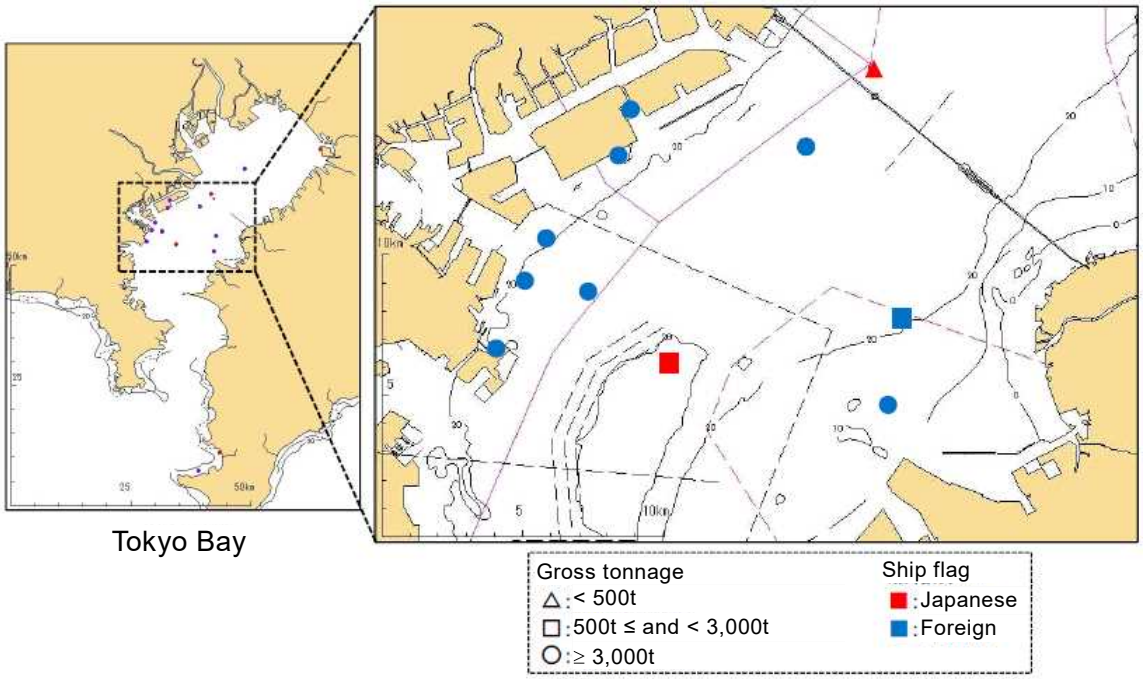
When not setting an anchor watch, the vessel was unable to check its conditions at an early stage. The ship could not get the latest weather and sea conditions, missing the timing of taking measures to prevent anchor dragging and the accident or incident occurred.



2. Location of anchor dragging accidents and incidents

Of the 68 vessels, 15 vessels experienced anchor dragging in Tokyo Bay, three in Beppu Bay, and three in Muroran Port.

Of the 15 vessels that had accidents in Tokyo Bay, 11 experienced anchor dragging near Nakanose, nine of which were foreign ships.



3. Water depth, extension of the anchor chain and the status of the anchor at anchoring

The holding power of a vessel is the sum of the holding power of its anchor in proportion to the nature of sea bottom at the anchorage and the holding power generated by the friction resistance of the anchor chain lying on the sea bottom.

To obtain a sufficient amount of holding power, the anchor needs to dig into the sea bottom, and the anchor chain needs to be extended in proportion to the water depth. However, when a vessel begins to drift due to strong winds, the anchor may be turned upside down, with the flukes facing upward. In this situation, the anchor cannot dig into the sea bottom, disabling it to get enough holding power.

According to some literature(*1), the extension of the anchor chain is empirically determined at the lengths shown below.

Anchoring in standard conditions: Water depth x 3 + 90m (3D + 90)

Anchoring in heavy weather conditions: Water depth x 4 + 145m (4D + 145)

*1 “Theory of Ship Handling” (First Edition, Satoshi Iwai, Kaibundo Publishing Co., Ltd., 1967)

According to “Ship Operation Manual” used by the Imperial Japanese Navy, definitions as shown below.

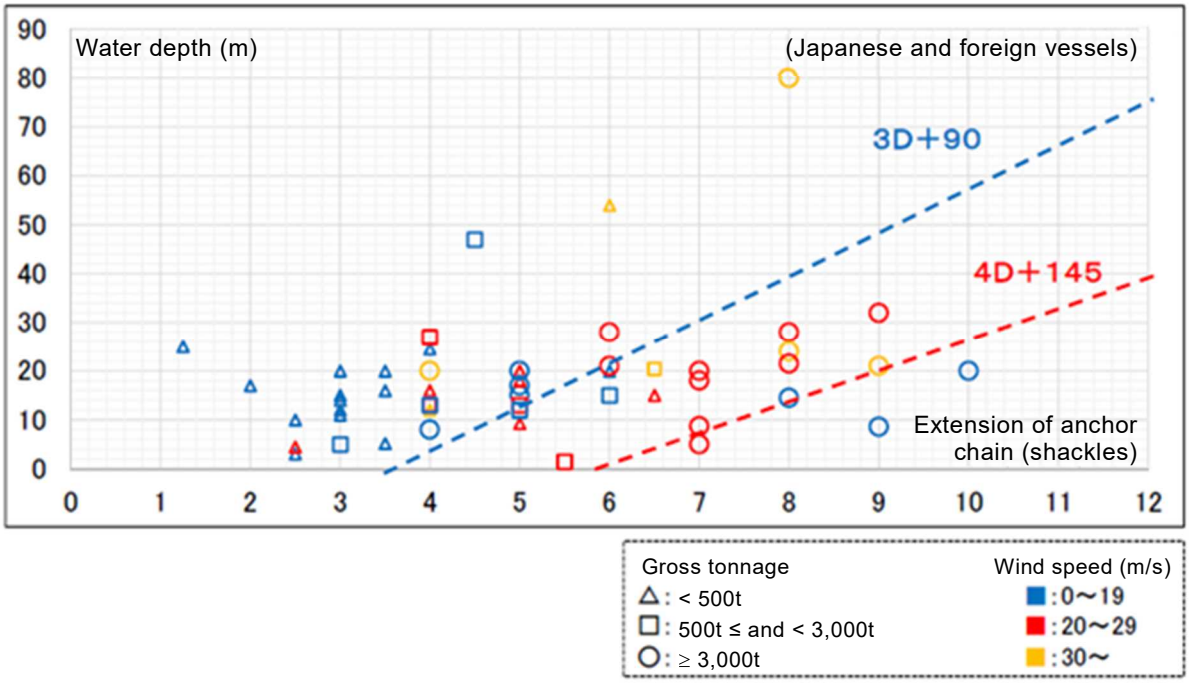
Standard conditions: When the vessel is receiving winds with a speed of 20m/s.

Heavy weather conditions: When the vessel is receiving winds with a speed of 30m/s.

For 52 vessels (whose status of anchoring was known) of the 68 that encountered anchor dragging, the chart below shows the relationship between water depths, extended anchor chain lengths, gross tonnage, and wind speeds. In the meantime, 51 vessels were moored using a single

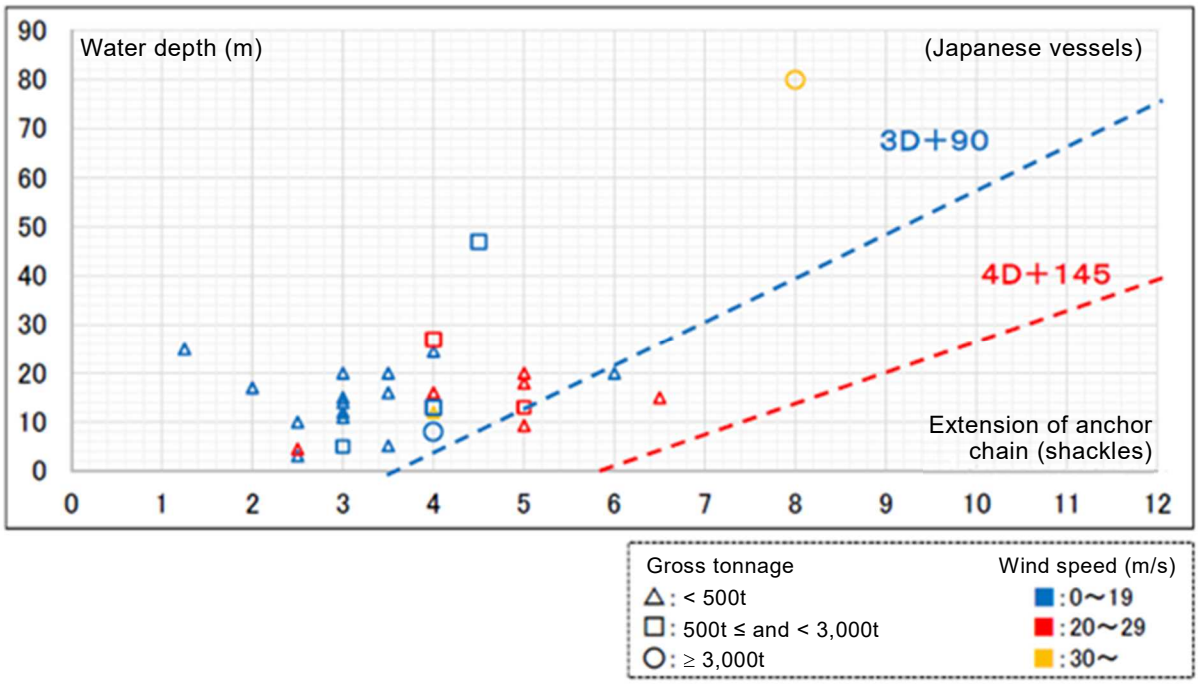
anchor.

In the chart, many of the vessels that dragged anchor are plotted on the left side of the lines representing “3D +90” and “4D + 145,” meaning the extension of anchor chain was too short. The shackle length of anchor chain was set at 25m.



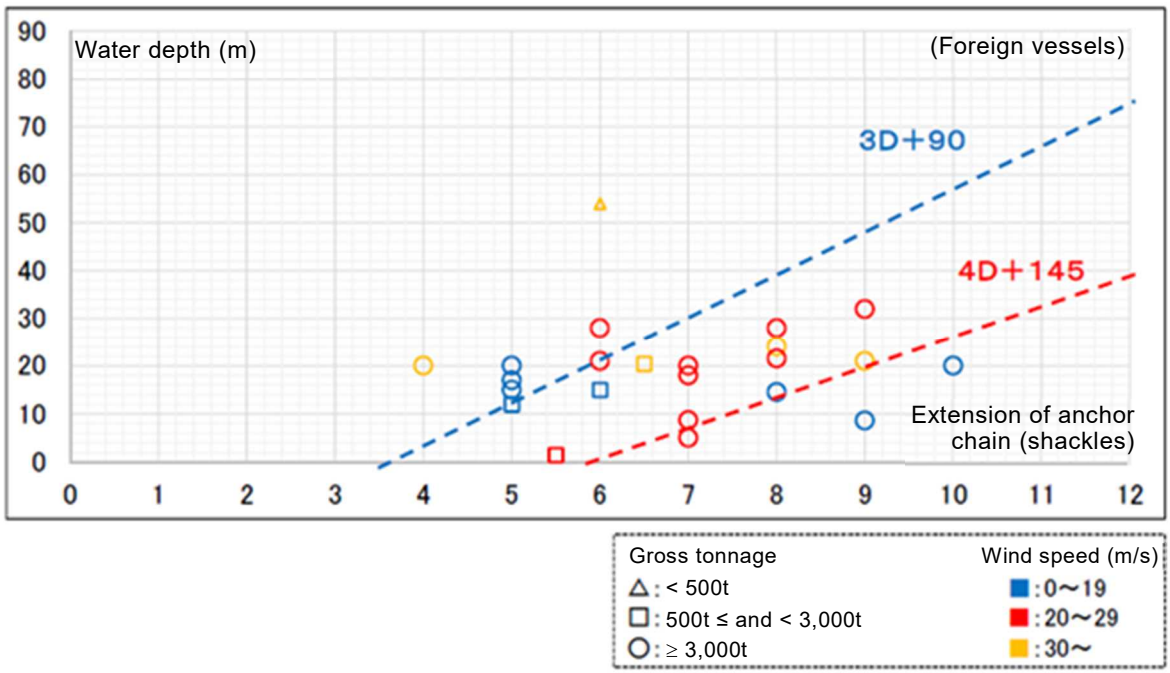
Looking at the 29 Japanese vessels whose situation was found, the largest number of vessels had a gross tonnage under 500 tons and received winds with a speed of 19m/s or less. 25 vessels of the 29 are plotted on the left side of the line representing “3D + 90,” which means their extension of anchor chain was too short.

In the meantime, 28 Japanese vessels were moored using a single anchor.



Looking at the 23 foreign vessels whose situation was found, the largest number of vessels had a gross tonnage of 3,000 tons or more and received winds with a speed of 20m/s or more. 20 vessels of the 23 are plotted on the left side of the line representing "4D + 145," which means their extension of anchor chain was too short.

In the meantime, all the 23 foreign vessels were moored using a single anchor.



4. Measures for preventing the recurrence of anchor dragging accidents and incidents

The following measures to prevent anchor dragging and other accidents and incidents are recommended.

(1) Obtain adequate information on weather and sea conditions to conduct the following checks

depending on the expected conditions of weather and sea, the sea area, and the nature of the sea bottom.

1) Consider a sufficient amount of anchor chain extension, the use of an anchor for swinging protection, and double-anchor mooring.
2) Set an anchor watch

(2) In the waters congested with many anchoring ships, there may be cases where you are unable to anchor depending on the expected weather and sea conditions, the sea area, and the nature of the sea bottom. In this case, consider changing the anchorage or mooring.

(3) In a coastal sea area, vessels that may cause anchor dragging should consider installing AIS that allows you to check the ship conditions expeditiously.

(4) If special instructions for anchor dragging are not fully described in your safety management manuals and procedures for mooring watch, add specific measures against anchor dragging.

(5) For foreign vessels, the concerned parties such as ship agents should proactively provide weather and sea conditions and other information relating to the anchorage.

*Publication of this information is detailed on the website of this Board.
http://www.mlit.go.jp/jtsb/iken-teikyo/s-teikyo13_20180828.pdf

(4) Provision of information "Measures for preventing anchor dragging accidents in the event of a very strong typhoon (interim report)"

(Information provided on December 20, 2018)

On September 4, 2018, very strong typhoon No. 21 passed through Osaka Bay, and an oil tanker anchored in the bay dragged anchor and ended up colliding against the Kansai International Airport Access Bridge. Furthermore, on October 1, 2018, when strong typhoon No. 24 passed the Kanto region, a foreign cargo vessel anchored in Tokyo Bay dragged its anchor, and it ended up colliding against a quay at Ogishima Keihin Port Kawasaki District. Two major anchor dragging accidents occurred one after another.

On the other hand, JTSB confirmed that despite the trouble these two vessels faced, many ships were anchored safely in Osaka Bay and Tokyo Bay. JTSB conducted a questionnaire survey in what conditions those vessels were and what action they took when the typhoons were approaching and passed, **summarizing the results as reference data, including best job practices**. JTSB would like shipping companies to disseminate this data in their safety training programs etc. to prevent the recurrence of similar accidents.

In its past publications, JTSB introduced the matters identified in the process of accident/incident investigations as well as the analysis results of already published investigation reports. This publication is **JTSB's "first" attempt to issue the data, including best job practices, based on the information obtained from the vessels and operators that obviated accidents and incidents.**

JTSB will provide this information to the following administrative agencies and interested organizations. JTSB will also post the same information on the website of this Board.

Notes

Administrative agencies: Safety Policy Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism; Navigation Safety Division, Maritime Traffic Department, Japan Coast Guard
Interested organizations: Japanese Shipowners' Association; Japan Passengerboat Association; Japan Long Course Ferry Service Association; Japan Federation of Coastal Shipping Associations; Japan Federation of Pilots' Associations; Japan Foreign Steamship Association; Japan Association of Foreign-trade Ship Agencies

Points of preventing anchor dragging accidents in the event of a very strong typhoon!

Take the following measures to prevent anchor dragging accidents in the event of a very strong typhoon.

1. To prevent anchor dragging, you should adopt a **double-anchoring method in principle**. Take the best possible measures, such as **extending the anchor chain as long as possible and ensuring sufficient amounts of holding and mooring power using the anchor and anchor chain**.
   Each vessel should determine the method of anchoring and the extension of the anchor chain depending on the vessel's environment, such as traffic congestion and the nature of the sea bottom.

2. Even if you choose the best anchoring method and anchor chain extension, there may still be a risk of anchor dragging in strong wind if you rely only on the holding and mooring power available from the anchor and anchor chain.
   Stand by the engine and use its power depending on the quickly changing wind directions and speeds to prevent anchor dragging. Precisely control the output of the engine depending on the changes in the environment.

3. Even if you take all the measures described in 1. and 2. above, still consider the risk of anchor dragging. **Select an anchorage where there are no critical facilities in the downwind direction, and there is enough distance between other vessels.**

4. When a typhoon is passing, wind directions and speeds will change quickly. You need to **obtain the latest information on weather and sea conditions (of the typhoon)** and accurate forecasts. **It is crucial to consider the exact timing in implementing each measure.**

*The publication of this information (full text) is posted on the website of this Board.
http://www.mlit.go.jp/jtsb/iken-teikyo/s-teikyo14_20181220.pdf

*"The status of vessels in Osaka Bay according to AIS data (excluding vessels staying in Osaka Port, from 11:30–14:30 on September 4, 2018)" is posted on the website of this Board.
http://www.mlit.go.jp/jtsb/video/ship/2017tk0010-movie.wmv

Column

Provision of information concerning the prevention of anchor dragging accidents and incidents to relevant administrative agencies and interested organizations

Marine Accident Investigator

"Anchor dragging." "Is an anchor running?" This term may be unfamiliar to many people other than those involved in the shipping industry. This word reads as "sobyo," meaning that the anchor is dragged when the external force applied to a vessel exceeds the holding power of the anchor and anchor chain. More simply put, this term means that "a ship mooring with its anchor placed on the sea bottom drifts when affected by winds and other factors." 2018 marked the year when "anchor dragging" gained prominent attention most.

On August 28, JTSB provided reference data named "Measures to prevent anchor dragging accidents and incidents" to two administrative agencies and seven interested organizations. This reference data is a summary of the essential parts of the investigation reports concerning anchor dragging (for 68 vessels) that JTSB had published in the past.

Just a week later, on September 4, when very strong typhoon No. 21 passed Osaka Bay, an oil tanker was anchored off the southeast coast of the Kansai International Airport. The tanker dragged anchor and collided with the airport access bridge. The damage to the road and railway significantly affected access to the airport. Using the data from the Automatic Identification System (AIS), JTSB confirmed that 54 vessels were anchored in Osaka Bay in the strong winds caused by this typhoon (excluding vessels in ports). For this reason, JTSB decided to survey what measures the vessels that obviated accidents took when the typhoon was approaching and passed. JTSB started with a questionnaire survey, and it analyzed the replies from 28 vessels and AIS data. (JTSB did this practice for the first time, and had to ask additional questions two or three times, causing the vessels and operators inconvenience.)

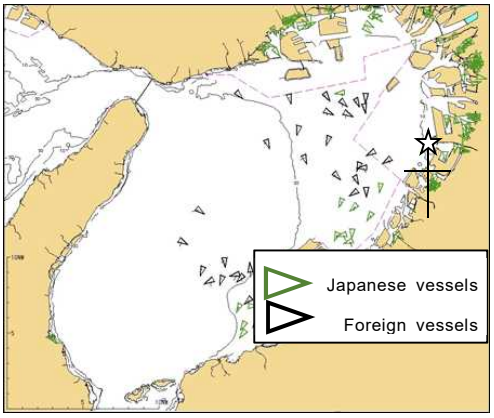
Furthermore, strong typhoon No. 24 passed the Kanto region from September 30 to October 1. A foreign cargo vessel anchored off Daikoku Wharf at Keihin Port Yokohama District dragged anchor and collided with the quay at Ogishima. According to AIS data, JTSB confirmed the presence of 420 vessels in Tokyo Bay (excluding those moored at quays). JTSB decided to conduct additional analysis based on a questionnaire survey for 65 vessels.

Thanks to the cooperation of 93 vessels (84 Japanese and nine foreign) and the operators that participated in the questionnaire survey, JTSB published reference data named "Measures for preventing anchor dragging accidents in the event of a very strong typhoon (interim report)" on December 20. The Board provided the data to two administrative agencies and seven interested organizations. When this publication was reported during TV news at 10:00 AM on that day, the Board members and investigators erupted into applause. As a responsible investigator, I actively want this information to spread among those who are navigating vessels in order to prevent accidents. At the same time, I felt a sense of relief.

In April 2019, JTSB published the "final report" that contained the case studies of the vessels that obviated accidents in Tokyo Bay.

It was the first time that JTSB surveyed “the vessels that obviated accidents” and prepared/published a safety promotion material. JTSB utilized the concepts and techniques of accident investigation and analysis that it developed in the past. I feel that this publication of information is unique to JTSB that intends to contribute to the prevention of accidents and reduced damage.
JTSB will continue to publish useful and timely information from its perspective so that it can contribute to the improved safety of vessel navigation.

Osaka Bay AIS data
(Sep. 4, 2018 13:40-13:45)



Chapter 6 Efforts toward accident prevention

1 Publications

The JTSB prepares and issues various publications, as well as investigation reports, regarding specific cases.

We place these publications on our website and, in order to make them more accessible to the public, we also introduce them through our monthly JTSB E-Mail Magazine service (only available in Japanese).

Our e-mail magazine service is widely used by people in the aviation, railway, and shipping industries, as well as administrative agencies and educational/research organizations.

We also exchange opinions with business operators and other parties on effective information dissemination from the JTSB, and we will continue to make improvements based on the opinions that we receive.

2 Issuance of the JTSB Digest

With the aim of fostering awareness of safety, and preventing similar accidents from occurring, we issue “JTSB Digests.” This publication introduces you to statistics-based analyses and must-know cases of accidents.

We also issue the English version of “JTSB Digests” as part of our efforts to disseminate information overseas.

In 2018, we released four issues of “JTSB Digests” (January, June, July and December: Issues No.

27-30).

The contents of each issue are as follows.

(1) JTSB Digest No. 27 [Marine accident analysis digest] “Analyses of engine failure-accidents and incidents of coastal cargo vessels and coastal tankers” (Issued on January 23, 2018)
- Occurrence trend of engine failure-related accidents and incidents
- Accident investigation case: “Cooling fresh water leaked into the crankcase, causing the seizure of main bearing metal, resulting in the inability to sail”
- Accident investigation case: “Sea water entered the fuel oil system and on-board power was lost, resulting in the inability to sail”
- Accident investigation case: “Breakage occurred to the cooling sea water inlet valve of the power generator motor, causing the immersion of the engine room”
- Accident investigation case: “Fuel return oil pipe broke and the spewing oil came in contact with a hot area, causing a fire”

(2) JTSB Digest No. 28 [Railway accident analysis digest] “To prevent derailment accidents — Key points in track maintenance” (Issued on June 28, 2018)

- Accident occurrence circumstances
- Accident investigation case: “Derailment due to rail tilting caused by continued failure of rail fastening device”
- Accident investigation case: “Derailment due to rail tilting caused by continued failure of sleepers”
- Accident investigation case: “Derailment of train due to rail breakage”
- Accident investigation case: “Track displacement in an exit-side transition curve caused the wheels to lift and derail”

(3) JTSB Digest No. 29 [Marine accident analysis digest] “To prevent accidents caused by leisure fishing boat crashes” (Issued on July 24, 2018)

- Occurrence circumstances of leisure fishing boat crashes
- Accident investigation case: “Crash due to failure to notice an anchored motorboat hiding in the blind spot created by bow elevation during navigation”
- Accident investigation case: “Crash due to failure to notice an anchored leisure fishing boat while checking a fishing spot with a GPS plotter during navigation”
- Accident investigation case: “Crash due to failure to notice an approaching leisure fishing boat while dealing with fishing customers during navigation”
- Accident investigation case: “Crash occurred because a fishing boat underway did not notice an anchored leisure fishing boat”

(4) JTSB Digest No. 30 [Aircraft accident analysis digest] “Trend in helicopter accidents and incidents” (Issued on October 25, 2018)
- Occurrence circumstances of helicopter accidents and incidents
- Accident investigation case: “Crash due to collision with trees”
- Accident investigation case: “Crash due to collision with power lines during release from hovering”
- Accident investigation case: “Crash into mountain slope”
- Accident investigation case: “Falling part (iron plate) during suspended cargo delivery”

Column

Let's learn necessary knowledge and behavior through "Good Job" cases!

— Accident prevention activities for small-scale business operators and individuals —

Director for Analysis, Recommendation and Opinion

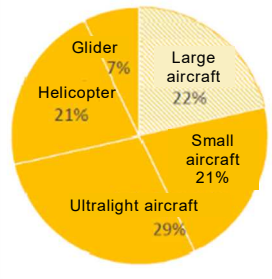
When hearing the name Japan Transport Safety Board, you may think of those who rush to the scene of a major accident with significant social impact to investigate the cause. It may be partly because television broadcasts tend to focus on major accidents. JTSB, however, also actively works on recurrence prevention of accidents involving relatively small business operators and individuals.

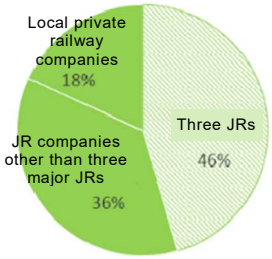
In fact, accidents involving small-scale business operators and individuals account for a large percentage of the total number of accidents. 2018 statistics show that aircraft accidents of small aircraft, etc. (i.e. other than large aircraft) account for 78% of a total of 14 accidents. In addition, when compared to the number of accidents in 1974 (when our predecessor, the Aircraft and Railway Accidents Investigation Commission, was established), the percentage of accidents involving small aircraft, etc. (41 to 11 cases), relative to the accidents of large aircraft (8 to 3 cases), remains at the same level (84% to 78%). These indicate that preventing accidents of small aircraft, etc. is important to reduce the total number of accidents. Similarly, regarding railway accidents, the sum of accidents in JR companies other than the three major JRs (East, West, Tokai) and local private railway companies account for 55% of a total of 11 railway accidents. For marine accidents, the sum of accidents of fishing boats, leisure fishing boats, casting boats, pleasure boats and wetbikes accounts for 62% of a total of 1,233 accidents.

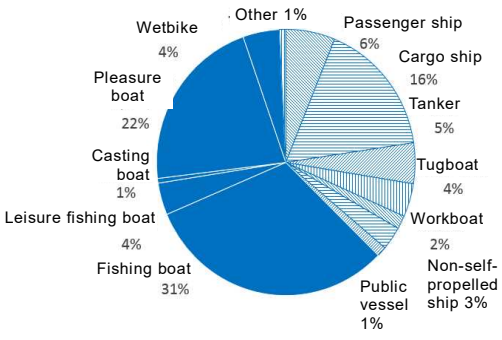
Accidents of aircraft other than large aircraft account for about 80% of total aircraft accidents (according to the number of accidents in 2018).

■ Aircraft accidents (total 14 cases) ■ Railway accidents (total 11 cases)

■ Marine accidents (total 1,233 cases)







The reasons for frequent accidents by small-scale business operators include the following: they may lack adequate safety management organizations/systems due to the scale of the business and as a result have only insufficient safety rules and operation procedures to ensure safety; and education and training to learn the rules, equipment usage skills, and so on may be inadequate. As a result, the field workers may lack sufficient knowledge and information required for quick thinking, making non-safe behavior and decision errors more likely. In such cases,

unless a systematic backup to fix the error is fully provided, an accident may occur.

In order to cope with such situations, JTSB examines real examples of accidents to pick up as many cases in which an accident might have occurred but was prevented ("Good Job" cases) and failure cases as possible, and summarize them simply. These examples can be seen in "JTSB Digest" *. We expect that the examples will serve as mock experiences of accidents and help field workers make appropriate decisions in the case of a near-miss situation in the field.

The "Good Job" cases in the Digest can be read on our website and are also introduced in various opportunities such as seminars and outreach lectures. However, there are still few places to provide Good Job cases to small business operators and individuals, which we consider one of the issues to be addressed. We plan to increase such opportunities, such as safety workshops held by business operators and clubs for individuals. We hope that learning "Good Job" cases will lead to an opportunity to enhance safety awareness and acquire necessary knowledge and behavior.

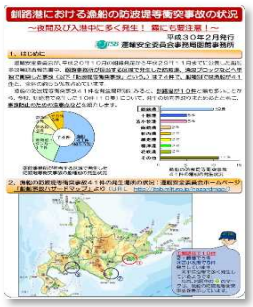
* JTSB Digests (for small-scale business operators and individuals published in the last 5 years)

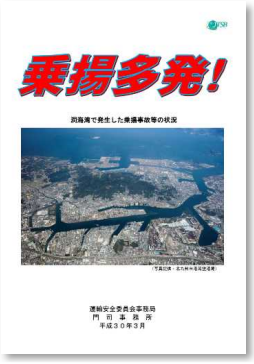
Aviation: No. 22 Private small aircraft, etc., No. 30 Helicopters,
Railway: No. 28 Maintenance and management of railway track,
Marine: No. 25 Pleasure boats, No. 29 Leisure fishing boats

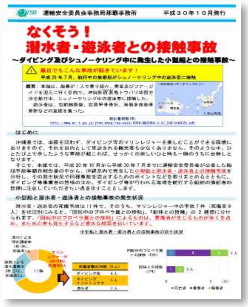
3 Issuance of the Analysis Digest Local Office Edition

The JTSB has issued the analysis digest local office edition (only available in Japanese). It has issued this publication in order to provide various kinds of information to help prevent marine accidents. The information is based on the analyses made by our regional offices and relates to specific accidents that occurred in their respective jurisdictions. This information focuses on cases with characteristic features such as the sea area, the type of vessel, and the type of accident.

(Analysis Digest Local Office Edition in 2018)

Hakodate	**Circumstances of accidents caused by a fishing boat crashing into the breakwater in Kushiro Port** **— Many accidents occur during the night and during entry into the port! Also pay careful attention to fog! —** (Main contents) - Circumstances of 41 accidents caused by a fishing boat crashing into the breakwater - Accident occurrence situation, circumstances by cause - Accident case studies (2 cases) - Summary — To prevent accidents caused by fishing boats crashing into breakwaters — 

Sendai	**About 60% of fishing boats involved in a crash did not notice the other ship before crashing.** **— Circumstances of ship-to-ship crashes involving a fishing boat —** (Main contents) - Occurrence circumstances of ship-to-ship crashes - Accident case studies (6 cases) - Summary (To prevent fishing boat crashes) 
Yokohama	**Early detection! To prevent immersion of engine room** **— Effective utilization of engine room bilge water level warning device —** (Main contents) - What is a level sensor? - Accident case: “The level sensor in the engine room had a malfunction, leading to a delayed detection of immersion, resulting in the widespread of damage” - Accident case: “The warning device was activated by the immersion of the engine room, but checks were not conducted anywhere, leading to delayed detection of immersion” 
Hiroshima	**In the Seto Inland Sea, many groundings / crashes are occurring due to operators falling asleep on the boat.** (Main contents) - Type of vessel of 41 ships involved in drowsy driving and the type of accident - Posture of bridge watchman and the steering condition when the operator fell asleep - Accident case studies (2 cases) - Summary (To prevent accidents caused by drowsy operation) 
Moji	**Groundings occurring frequently!** **Circumstances of groundings in Dokai Bay** (Main contents) - Ensuring safe navigation environment in Dokai Bay - Countermeasures for groundings - Safe navigation in Dokai Bay - Groundings cases in Dokai Bay (4 cases) - Summary 

Nagasaki	**To ensure safety in passenger transport** **— Analysis of passenger injury accidents along the Kyushu West Coast —** (Main contents) - Q & A regarding passenger injury accidents - Summary (To prevent/reduce passenger injuries and damage due to hull vibration) - Request to passengers	
Naha	**No more accidents caused by immersion of small ships!** **— Back to basics —** (Main contents) - Occurrence factors related to inspection and maintenance - Occurrence factors related to anchorage - Occurrence factors related to waves	
	No more accidental contact with divers/swimmers! **— Accidental contact with small ships during diving or snorkeling —** (Main contents) - Circumstances of accidents with diving ships - Accident case studies (3 cases) - Summary (To prevent fatal accidents and injury of divers/swimmers caused by contact with small ships)	

As you read these local office digests, you can not only find out the circumstances of local accidents, but can also gain some tips for accident prevention.

The local offices will make further efforts to regularly issue the analysis digest local office editions. By doing so, they will ensure that you will be provided with more satisfactory content.

Column

Speedy investigation of foreign ships

Sendai Office

Need of speedy response to foreign ships

Foreign ships depart the port and leave Japan as soon as the required procedures are completed, even after an accident. Therefore, investigators must be dispatched immediately. It is also needed to minimize the delay in the schedule to reduce the costs for cargo transportation*.

* It may cost several million yen per day, depending on the scale of the ship.

Problems in actual experience

- Visiting and investigating a ship alone with no interpreter (A [possibly dangerous] ship with the flag of Country A)

During a business trip in Prefecture B to investigate another case, the investigator was informed that a ship with the flag of Country A had an engine incident and became unable to continue sailing, and that the ship was pulled by a tug boat and entered another port in Prefecture B. In the evening, when calling the office to make a report, the investigator was ordered by the director to head for the ship next day and make an investigation.

All the crew members of the ship were nationals of Country A. However, there was information that they understood English. When the investigator contacted the agent, the agent said that they would give the ship notice but could not go with the investigator. As a result, the investigator had to visit and investigate the ship alone.

The investigator arrived at the quay designated by the SOLAS convention, where the ship was moored. For security reasons, the ship was tied up away from other ships. There was no one around.

Fortunately, there was a security guard at the quay gate. Thinking that there might be a need to ask the security guard to wait just outside the ship in case of a worst-case situation, the investigator observed the attitude of the Captain and the Officer at the gangway, which was alright, before entering the ship.

- Difficult communication (Captain of the ship spoke little English.)

The investigator tried to explain to the Captain and the Chief Engineer that JTSB would not examine their responsibility but just would investigate the facts to prevent re-occurrence and asked for their cooperation, but they barely understood. The investigator was puzzled and thought that may be his/her English was too poor, but fortunately the Officer was good at English, and the investigator was finally able to make him/herself understood.

It was found out later that the Captain and the Chief Engineer spoke only a little English.

- Making efforts to build a trusting relationship

The investigator made a persistent effort to explain the purpose of JTSB and that JTSB would not examine their responsibility, trying to build a trusting relationship. At this point, it is important to create a peaceful atmosphere. An acrid atmosphere should be avoided.

(It may make the crew members angry.)

At the same time, it is also important to keep one's guard up.

This was all that the investigator could do, and it was not impossible to secure time to obtain sufficient objective data.

Lessons learned

- Due to time constraints, it is important that multiple persons visit the ship to obtain objective data.

The ship was planned to leave the port as soon as receiving the repair parts of the main engine, replacing the parts, performing commissions, and receiving classification survey. In addition, a long-time investigation will reduce the willingness of the crew to cooperate.

Data collection, interviews and photography need to be done efficiently. For this reason, we, although in a regional office with little staff, are trying to ensure that at least two persons visit the ship for investigations whenever possible.

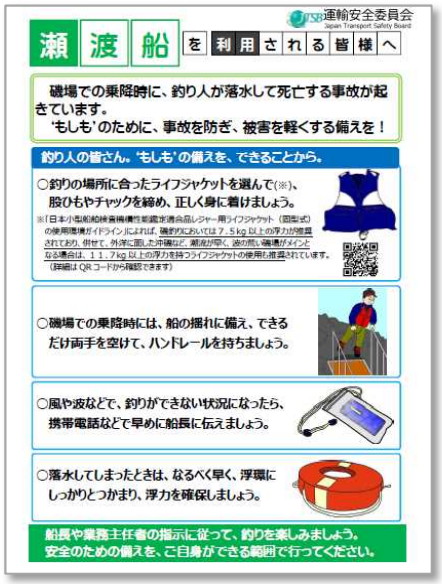
4 Issuance of the JTSB Annual Report

In June 2018, we issued the JTSB Annual Report 2018. We did so in order to share the lessons learned from accidents and incidents with interested parties, by introducing our general activities in 2017.

As part of our efforts to provide information overseas, we issued the English version of the report “Japan Transport Safety Board Annual Report 2018” on December 2018. We did so to let people overseas know about the topics in this Annual Report.

5. Preparation of safety leaflet

When the Japan Transport Safety Board published the JTSB Digest or releases investigation reports on accidents and incidents for which measures to prevent the recurrence thereof need to be urgently implemented, it prepared single-page, A4-sized leaflets to let as many people as possible see various safety information mentioned in them. To raise attention to the prevention of accidents, the board distributed the leaflets at event venues and asked organs concerned for cooperation in distributing them.



To those who use a casting boat for fishing

Prepare well and enjoy a safe and secure flight!

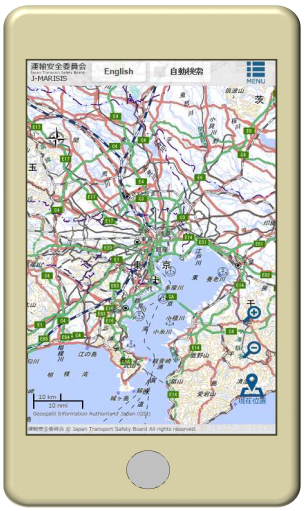
6 J–MARISIS – Now even easier to use

So that more effective use can be made of published marine accident investigation reports, the Japan Transport Safety Board began providing the Japan-Marine Accident Risk and Safety Information System (J -MARISIS) as an Internet service from the end of May 2013, allowing users to search reports from maps. In April 2014, we also released the global version of J-MARISIS, further allowing users to search investigation reports published by overseas marine accident investigation organizations from world maps.

Given the increase in the number of people using the Internet on mobile terminals, as well as requests to make this system easier to use on smartphones and tablets, we released the mobile version of J-MARISIS at the end of June 2015.

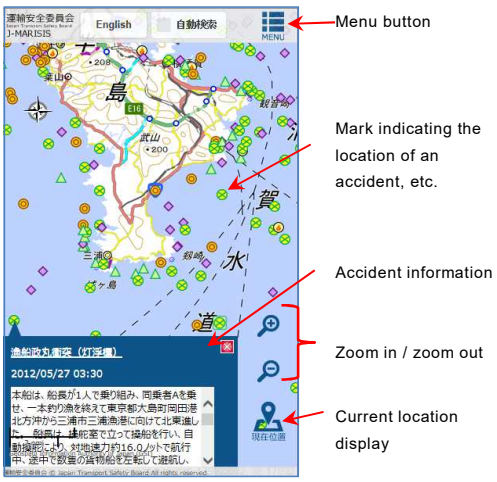
With touch panel support as well as revised display buttons and layouts, its ease of use has been increased, and the GPS functions of mobile terminals can be used to display information on areas near the user's current location. As a result, users on pleasure boats, recreational fishing boats or other small vessels can easily check information on accidents and other relevant information on navigation in sea areas they are planning to visit.

J-MARISIS http://jtsb.mlit.go.jp/hazardmap/mobile/index_en.html



Top page

Screen showing the information of current location using GPS function



Screen showing accident information

○ The service can be used free of charge, excluding the connection fee. The traffic volume of ships and fishing points will also be indicated.

The Japan Transport Safety Board welcomes your views, requests and other comments/communication from users of J-MARISIS. Please use the “Contact us” section of our website.

Contact us http://www.mlit.go.jp/jtsb/contact.html

7 Outreach lectures (dispatch of lecturers to seminars, etc.)

Scene of an outreach lecture

The Japan Transport Safety Board holds a series of outreach lectures as part of its efforts to raise awareness on the work of JTSB, and to create an opportunity for collecting the feedback and opinions of the general public.

Seminars that lecturers can be dispatched to cover topics that are useful in preventing or mitigating damage from aircraft, railway, and marine accidents. Members of the staff are dispatched as lecturers to various seminars and schools.

We can provide flexible support for the content of lectures, such as by incorporating content to match the needs of participants, based on courses chosen by requesting groups.

http://www.mlit.go.jp/jtsb/demaekouza.html (in Japanese)

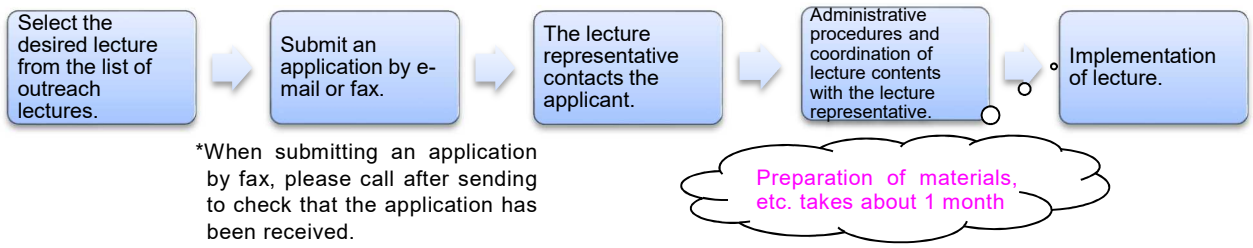
List of outreach lectures

No.	Course	Main audience	Contents
1	About the Japan Transport Safety Board	General (High school students and older), transportation businesses, etc.	Easy-to-understand explanation about the organizational background, work, etc. of the Japan Transport Safety Board
2	What is accident investigation?	Elementary school students	Easy-to-understand explanation about accident investigation for elementary school students and older
3	About aircraft accident investigation	General (High school students and older), aviation businesses, etc.	Easy-to-understand explanation about aircraft accident investigations, including the background, concrete examples, etc.
4	About railway accident investigation	General (High school students and older), railway businesses, etc.	Easy-to-understand explanation about railway accident investigations, including the background, concrete examples, etc.
5	About marine accident investigation	General (High school students and older), maritime businesses, etc.	Easy-to-understand explanation about marine accident investigations, including the background, concrete examples, etc.
6	About marine accident investigation (fire, explosion, engine failure)	General (High school students and older), maritime businesses, etc.	Explanation about marine accident investigations related to fire, explosion and engine failure, including the background, concrete examples, countermeasures, etc.
7	About the JTSB Digests	General (High school students and older), transportation businesses, etc.	Introduction to case studies of accidents and explanation of various statistical materials across various modes, based on the JTSB Digests that have been issued to date.
8	About the JTSB Digests (Analyses of Aircraft Accidents)	General (High school students and older), aviation businesses, etc.	Explanation about various themes taken up in the analyses of aircraft accidents in the JTSB Digests.
9	About the JTSB Digests (Analyses of Railway Accidents)	General (High school students and older), railway businesses, etc.	Explanation about various themes taken up in the analyses of railway accidents in the JTSB Digests.

10	About the JTSB Digests (Analyses of Marine Accidents)	General (High school students and older), maritime businesses, etc.	Explanation about various themes taken up in the analyses of marine accidents in the JTSB Digests.
11	Trends in the occurrence of marine accidents, and preventing recurrence	General (High school students and older), maritime businesses, etc.	Schematic explanations about risks and waters where marine accidents frequently occur using the J-MARISIS, and explanations about accident prevention methods.
12	Analysis digests of regional offices (marine accident-related) [each regional office in Hakodate, Sendai, Yokohama, Kobe, Hiroshima, Moji, Nagasaki, and Naha]	General (High school students and older), maritime businesses, etc.	Explanations on each topic regarding analysis digests from regional offices. *Lists can be found by clicking the link below. http://www.mlit.go.jp/jtsb/bunseki-kankoubutu/localanalysis/localanalysis_new.html

*No. 12, in principle, is restricted to requests from the areas under the jurisdiction of the local office.

Flow chart from application to implementation of lecture



8 Activities of the Accident Victim Information Liaison Office

The Japan Transport Safety Board gives full consideration to the emotions of the victim and their families, as well as bereaved families. In addition to providing information on accident investigations in an appropriate manner at the appropriate time, a contact point for providing accident investigation information to victims, etc. was established in April 2011 with the aim of providing attentive response to opinions and feedback. Furthermore, in order to promote the provision of information, the Accident Victim Information Liaison Office was established under the directive of the organization in April 2012. Contact points for the provision of information were also set up in local offices to provide integral support alongside with Tokyo.

In 2018, information on accident investigation and other matters was provided to 71 persons, including the victims, of 36 cases of aircraft/railway/marine accidents.

The status for other activities is as follows.

○Memorials for accident victims

The JTSB made memorial visits to accident sites including Mount Osutaka in Ueno Village, Tano District, Gunma Prefecture, the site of the JAL Flight 123 crash, and presented offerings of flowers from

the Board members and the Director-General at each accident site including the “Inori no Mori (Memorial Grove), the site of the Fukuchiyama Line Accident in Amagasaki City, Hyogo Prefecture, to express our deepest sympathy for those lost in these accidents.

By presenting these memorial offerings first-hand, we deeply felt the emotions of those who still have painful memories of these events, and renewed our awareness of the importance of closely sharing the feelings of bereaved families and victims.

Prayer at the altar for flowers at the Mount Osutaka crash site

The Accident Victim Information Liaison Office hands out “Contact Information Cards” to victims of accidents.

The Office receives inquiries and consultation about the accident investigations from victims and families of accidents, as well as bereaved families. Please feel free to contact the following where necessary.

Contact Information Cards

(Front)

(Back)

Column

Retransfer of Japan Transport Safety Board

General Affairs Division

On June 4th, 2018, the Tokyo Office of Japan Transport Safety Board was temporarily transferred to Otemachi Government Building No. 3 located at Otemachi 1-chome, Chiyoda-ku, Tokyo, due to the layout change of the divisions of Ministry of Land, Infrastructure, Transport and Tourism, then located in the Central Government Building No. 2 and adjacent building No. 3. On March 4th, 2019, the office of JTSB was moved back to Central Government Building No. 2 at Kasumigaseki 2-chome, Chiyoda-ku, Tokyo.

The Otemachi Government Building No. 3 was very old and inconvenient in several respects. For example, the air conditioner broke down around the end of the rainy season, when the real summer was about to start. Also, when you called the elevator on the 8th floor, it would go all the way up to the 10th floor before arriving at the destination. On the other hand, there were many good restaurants around the building and even the JTSB staff particular with their tastes were so satisfied with the food that there were even some who did not want to go back to Kasumigaseki.

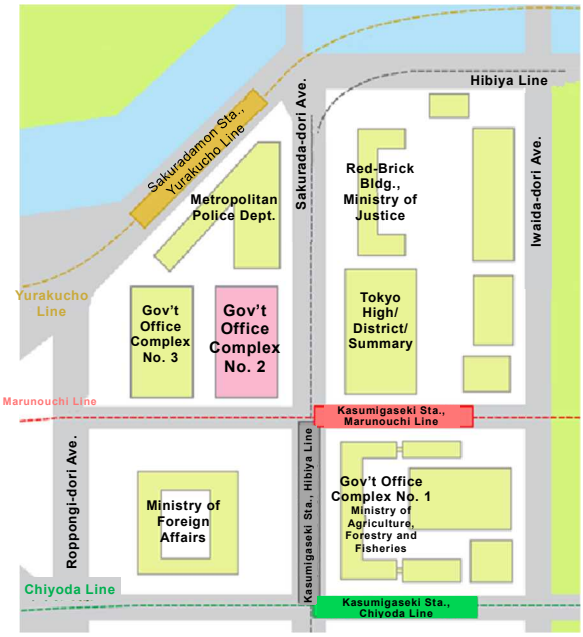
After the retransfer, the offices of General Affairs Division and the Director for Management are on the 16th floor, the offices of aircraft, railway and marine accident investigators are on the 15th floor, and the committee room is on the 14th floor. Although the divisions are located over different floors, their cooperation in daily operations has been further strengthened by the two relocations.

[Address after retransfer]

Japan Transport Safety Board

Central Government Building No. 2, 14F to 16F, 2-1-2 Kasumigaseki,
Chiyoda-ku, Tokyo, 100-8918, Japan
Telephone: +81-3-5253-8486 (main)
* Calls can be forwarded from the main phone number for the Ministry of Land, Infrastructure, Transport and Tourism (81-3-5253-8111).

Central Government Building No. 2



Information map

Chapter 7 International efforts for accident prevention

1 Objectives and significance of international cooperation

Aircraft and marine accidents, which are part of Japan Transport Safety Board's investigation scope, are international in nature. Creating and operating systems for these kinds of investigations therefore involve international organizations. Also, it is necessary to cooperate and coordinate with the accident investigation authorities of the states concerned during the investigation process.

In addition to the nation where an aircraft accident occurred, the state of registry, the state of the operator, and the state where the aircraft was designed and manufactured are the states concerned. An annex to the Convention on International Civil Aviation (the Chicago Convention) states that the state of occurrence is responsible for starting and accomplishing an accident investigation while the other states also have the right and responsibility to appoint a representative to participate in the investigation. Proper cooperation with the accident investigation authorities of those states concerned is necessary for the accomplishment of the investigation.

Similarly, in marine accidents involving vessels above a certain level, the International Convention for the Safety of Life at Sea (SOLAS) places the obligation of investigation on the flag state of the vessel. Additionally, other states concerned, such as coastal states in whose territory the marine accident occurs and the state(s) of victims are entitled to investigate the accident. The convention defines the standard framework of marine accident investigations. The flag state and states concerned must cooperate with each other in multiple ways, such as through information sharing, when conducting accident investigations.

Based on this background, a variety of international meetings are held for each mode, which JTSB actively participates in. The meetings are for the purpose of facilitating collaboration in the case of accidents or incidents, sharing information on accidents and investigation methods on a regular basis, and achieving results of prevention for repeated accidents all over the world. Additionally, for the investigation of railway accidents, for which there is no international organization, various international seminars to exchange information on accident and incident investigations are held in major countries. In regards to this, the fundamental investigation system of each state is generally standardized. Furthermore, some universities overseas have specialized training courses for accident and incident investigations, to which JTSB is also actively dispatching investigators.

As shown above, JTSB aims to improve transport safety in Japan and all over the world. It hopes to do so through sharing of our findings worldwide, which have been acquired in individual accident and incident investigations. Relating to this, the following sections introduce each of our international activities in 2018.

2 Efforts of international organizations and JTSB's contributions

(1) Efforts of the International Civil Aviation Organization and JTSB's involvement

The International Civil Aviation Organization (ICAO, Headquarters: Montreal, Canada) was established as a specialized agency of the United Nations in 1947. Japan acceded to it in 1953.

ICAO comprises the Assembly, Council, Air Navigation Commission (a supporting body of the Council), Legal Committee, Air Transport Committee, and Committee on Joint Support of Air Navigation Services, all of which are the subordinate bodies of the Council, secretariat and regional offices. In addition, Air Navigation Conferences, Regional Air Navigation meetings, a variety of working groups and panel meetings, which are called in for certain projects. As of March 2019, 192 states are members of ICAO.

The objectives of ICAO is provided in Article 44 of the Convention on International Civil Aviation as being "to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport." ICAO is engaging in a wide variety of activities, including the drafting of conventions regarding international air transport services and aviation security such as countermeasures against hijacking. It also engages in audits of contracting states' safety monitoring systems, and responses to environmental problems.

ICAO establishes the Annexes of the Convention on International Civil Aviation for items that must be covered by globally unified rules. The Annexes determines the rules for 19 fields, including personnel licensing, rules of the air, registration of aircraft, airworthiness, aeronautical telecommunications, search and rescue, security, and the safe transport of dangerous goods and safety management. Among them, Annex 13 establishes the standards and recommendations for aircraft accident and incident investigations. In addition, the Act for the Establishment of the Japan Transport Safety Board states that: "The Board shall conduct investigations prescribed in items (i) to (ii) of Article 5 in conformity with the provisions of the Convention on International Civil Aviation and with the Standards, Practices and Procedures adopted as Annexes thereto." (Article 18).

The Accident Investigation Group Panel (AIGP), a subordinate body of the Air Navigation Commission, is a place where members have discussions mainly about the amendment of Annex 13 and the draft of guidance materials. In AIGP/4 held in May 2018, JTSB became a panel member and participated in the discussions in particular from the perspective of the state of design/manufacturing, against the backdrop of the development of domestic jet passenger aircraft.

In addition, the Asia Pacific Accident Investigation Group (APAC-AIG) operates as a framework for safety in Asia and Pacific Regions, and considers the building of a cooperative system for accident investigation in these regions.

APAC-AIG/6 (Thailand)

In APAC-AIG/6 held in Bangkok, Thailand, in October 2018, an aircraft accident investigator participated from JTSB, who conducted debates on the accident investigation-related issues in light of the local characteristics in the Asia-Pacific region and discussed how to improve the investigation capability and promote inter-country cooperation in the region.

(2) Efforts of the International Maritime Organization and JTSB's involvement

The International Maritime Organization (IMO, Headquarters: London, United Kingdom) was established in 1958 as a specialized agency of the United Nations. It was originally called as the

Inter-Governmental Maritime Consultative Organization (IMCO). The IMO comprises the Assembly, the Council and five committees. These are the Maritime Safety Committee (MSC), Legal Committee (LEG), Marine Environmental Protection Committee (MEPC), Technical Co-operation Committee (TC) and Facilitation Committee (FAL). In addition, there is a Secretariat, and the MSC (and MEPC) has seven subcommittees. As of March 2019, IMO has 174 member states/territories and three regions as associate members.

III5

IMO engages in various activities, such as the facilitation of intergovernmental cooperation, effective safety measures and drafting of conventions that relate to technical and legal problems with maritime life safety and safe marine navigations.

The Sub-Committee on Implementation of IMO Instruments (III) is a subordinate group of MSC and MEPC. It discusses how to ensure the responsibility of the flag state, including the investigation of marine accidents and incidents. III analyzes the accident or incident investigation reports submitted from states based on SOLAS and the International Convention for the Prevention of Pollution from Ships (MARPOL) to draw lessons from, which III subsequently makes public on the IMO website. By doing so, III promotes activities for the prevention of the repeated occurrence of marine accidents.

The Correspondence Group (which undertakes analysis during periods outside of the sessions) and the Working Group (which verifies the analysis results during the session period) comprises volunteer investigators from some member states. They discuss these analysis results, which the III plenary subsequently approves. Depending on the matter in question, if III determines that further discussion is required for a convention revision, it will submit recommendations or information to MSC, MEPC and other IMO subcommittees. The III5 was held in September 2018. In this event, JTSB's marine accident investigators took part as group members and analyzed accident investigation reports from various states. Tentative translations of these analysis results are published on JTSB website.

(URL: http://www.mlit.go.jp/jtsb/casualty_analysis/casualty_analysis_top.html)

3 Cooperation and information exchange with foreign accident investigation authorities and investigators

(1) Participation in international meetings

① Chairperson meeting of the International Transportation Safety Association

The International Transportation Safety Association (ITSA) was established by accident investigation boards from the Netherlands, the United States, Canada, and Sweden in 1993. As of March 2019, the international organization has members from the transport accident

ITSA 2018 Meeting of the Chairpersons (Azerbaijan)

investigation authorities of 16 countries and territories. Organizations that are permitted to join must be permanent accident investigation authorities that are independent from any regulatory authority.

Based on the idea that any findings from an accident and incident investigation in one field can be used as a lesson for another field, ITSA holds annual chairperson meetings where the participating accident investigation authorities present their experiences in accident investigation. These presentations are for all the modes of aviation, railway, and marine accidents and incidents. The chairpersons learn about the causes of accidents and the methodologies of accident investigations, thus aiming to improve transport safety in general. As for Japan, the Aircraft and Railway Accidents Investigation Commission was approved for accession in June 2006. The board has participated in all the meetings held after 2007.

In the meeting held in Baku, Azerbaijan, in May 2018, the chairperson and board members of JTSB participated and give a presentation on the Shinkansen derailment accident caused by an earthquake and its countermeasures.

② International Society of Air Safety Investigators and Asian Society of Air Safety Investigators

The International Society of Air Safety Investigators (ISASI) has been organized by national aircraft accident investigation authorities. The purpose of this society is to support accident investigations aimed at preventing repeating occurrences of aircraft accidents and incidents. This aims is to be achieved by improving further a cooperative system of investigation authorities, through the facilitation of communications between member countries about their experience and knowledge, as well as information about the technical aspects of aircraft accident investigations.

ISASI holds annual seminar each year, and Japan has participated in each one of them since the establishment of Japan Aircraft Accident Investigation Commission in 1974. In this seminar, working groups including the Flight Recorder Working Group, the Investigator Training and Education Working Group, the Cabin Safety Working Group, and the Government Air Safety Investigators Group are held in parallel with the general meeting. Japan also participates in these working groups to contribute to technical improvements in these areas.

ISASI Annual Seminar (UAE)

In the 2018 Annual Seminar held in Dubai, UAE, with the theme “Future Development and Challenges to Investigation”, JTSB’s aircraft accident investigator participated and exchanged opinions actively with those who are involved in accident investigations in other countries.

ISASI has regional associations in Australia (ASASI), Canada (CSASI), Europe (ESASI), France (ESASI French), Korea (KSARAI), Middle East and North Africa (MENASASI), Latin America (LARSASI), New Zealand (NZSASI), Pakistan (PakistanSASI), Russia (RSASI), the United States (USSASI) and Asia (AsiaSASI). Each of these associations also holds their own seminars.

In AsiaSASI, JTSB currently serves as Chairperson, with Hong Kong Civil Aviation Department

as Vice Chairperson, and Transport Safety Investigation Bureau of Singapore as Secretariat.

③ Accident Investigator Recorder (AIR) Meeting

The Accident Investigator Recorder (AIR) Meeting is an international conference for aircraft accident investigators who analyze digital flight data recorders (DFDR) and cockpit voice recorders (CVR). At this meeting, aircraft accident investigation analysts from all over the world share know-how by exchanging their experience, knowledge, information relating to the analysis of DFDR, and discuss the relevant technologies on DFDR. The conference aims to further develop the technical capacity of accident investigation authorities around the world and to further improvement the cooperative system amongst the authorities.

This meeting was established in 2004, and the accident investigation authorities of each country hold a meeting every year. JTSB has participated in nearly all the conferences since 2006.

In the meeting held in Taipei, Taiwan, in September 2018, JTSB's aircraft accident investigator participated and exchanged information and opinions with accident investigators in charge of analysis in other countries, to collect and accumulate the latest information related to the analysis of flight recorders.

④ Marine Accident Investigators' International Forum

The Marine Accident Investigators' International Forum (MAIIF) is an international conference held annually since 1992. It was originally based on a proposal from the Transportation Safety Board of Canada. Its purpose is to maintain and develop international cooperation among marine accident investigators and to foster and improve international cooperation in marine accident investigations. Its aim is to advance maritime safety and prevent marine pollution. In 2008, MAIIF was granted the status of an Inter-Governmental Organization (IGO) in IMO.

MAIIF27
(Singapore)

Under this forum, marine accident investigators around the world take the opportunities to exchange frankly opinions and share information on marine accident investigations. Recently, there has been more demand to make use of the findings obtained from the marine accident and incident investigations in the discussions in IMO. In 2009, MAIIF made a proposal based on the investigation results from the state investigation authorities to IMO for the first time. Japan has joined and actively contributed to the forum every year since the third conference and hosted the eighth conference in Tokyo in 1999.

In the 27th meeting held in Singapore in November 2018, JTSB's marine accident investigators participated and made a presentation on the case where JTSB gained the cooperation of overseas investigation authorities for a marine accident investigation.

⑤ Marine Accident Investigators Forum in Asia

The Marine Accident Investigators Forum in Asia (MAIFA) was established by a proposal from Japan to build a mutual cooperation system for marine accident and incident investigations in the

Asia region and to assist developing countries in enhancing their investigation systems. Since 1998, meetings have been held annually, and Japan has been playing a leading role in this forum, including the sponsorship of the 13th meeting in Tokyo in 2010. The network of investigators that has been established through the forum is now effective in its promotion of rapid and smooth international cooperation in accident and incident investigations. Encouraged by the success of MAIFA, E-MAIIF was established in Europe in 2005. A-MAIF was then established in North, Central and South Americas in 2009. These trends contribute more than ever in furthering the exchange and cooperation between marine accident investigators in each region. In the Asia region, there are not only a lot of straits with sea traffic congestion, but also severe weather and hydrographic phenomena that often give rise to tragic marine accidents. Nonetheless, some countries have insufficient capacities or systems for accident investigations. This situation makes these regional fora very important.

MAIFA21
(the Republic of Korea)

In the 21st meeting held in Seoul, the Republic of Korea, in October 2018, JTSB's marine accident investigator participated and made a presentation on major marine accident investigation cases in which JTSB was involved.

(2) Examples of international cooperation among accident investigation agencies in individual cases

For the aircraft accident and incident investigations, based on the provisions in Annex 13 of ICAO, the state where an aircraft accident occurred must notify the state of registry, the state of design/manufacturing, and the state of operation. If necessary, these states concerned may appoint their own Accredited Representative (AR) to join the investigation.

When in March 2018 an Airbus A320-214 belonging to Peach Aviation was holding on the runway with its nose-gear tire facing sideways after landing at Fukuoka Airport, JTSB conducted an investigation in cooperation with the accident investigation authorities of France, the state of design/manufacture, and Taiwan, where a company that had once been involved in the maintenance of the aircraft was located. Also, when in June 2018, a Boeing 777-300 belonging to Korean Air landed at Narita International Airport but while taxing on the ground, was holding on the taxiway due to damage of the right main landing gear, and could not continue taxing, JTSB conducted an investigation in cooperation with the accident investigation authorities of the Republic of Korea, the state of registry and operation, and the U.S., the state of design/manufacture.

In marine accident and incident investigations, the IMO Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code) states that the interested states, including the flag state of the ship and the coastal state of the accident, must cooperate in the marine accident investigation. Also in Japan, if a marine accident or incident occurs that concerns more than one state, Japan's accident investigators are to collaborate with the accident investigation authorities of the other interested states in order to obtain information about the accident.

Among the marine accidents and incidents that JTSB launched investigations in 2018, with regard to the seven serious accidents involving ships engaged on international voyages, the accident investigation authorities of the states to which the ships were registered were notified of the accidents.

When in October 2018, the cargo ship ERNA OLDENDORFF registered with Malta contacted with the Oshima Bridge in Yamaguchi Prefecture, JTSB conducted an investigation in cooperation with the accident investigation authority of Malta, the flag state of the ship. Also, when in December 2018, the passenger ship NIPPON MARU registered with Japan contacted with the port facility while leaving the Port of Guam, JTSB conducted an investigation in cooperation with the accident investigation authority of the U.S., which was the coastal state.

Among the marine accident and incident investigation reports that were published in 2018, JTSB sent five draft reports to the flag states and other interested states upon request in order to invite their comments.

4 Technical cooperation

Since successive railway accidents occurred in India, a railway safety expert team constituted by the Japanese government, including a board member and two railway accident investigators of JTSB, was dispatched to Delhi. In the seminar held there, JTSB explained the Japanese accident investigation system and procedures based on the current state of accident investigations in Japan.

After that, according to the request from the Indian Government, “The Project for Capacity Development on Railway Safety” was launched as a technical cooperation of JICA (Japanese International Cooperation Agency). The first meeting of the project was held in Delhi in December 2018, and a board member and two railway accident investigators of JTSB attended.

JTSB will actively participate in the project that is about to begin, and provide information on the railway accident investigation procedures in Japan, so as to contribute to the improvement of railway safety in India.

5 Participation in overseas training

JTSB is making efforts to advance the capacity of accident investigators through measures such as training and international information exchanges to investigate accidents accurately, and also actively participates in overseas training for accident investigations.

In 2018, JTSB made efforts to improve our accident investigation capabilities, continuing from the previous year to dispatch an aircraft accident investigator and a marine accident investigator to Cranfield University in the UK, which has a good track record in accident and incident investigation training. The content of this training session lets the participants learn about a variety of topics, from the basics to expert knowledge about accident investigations. After the training, the participating investigators made the other investigators of each mode of transport aware of what was learned in the training, thereby helping to improve the capabilities of all of our investigators.

JTSB also dispatched an aircraft accident investigator to training held by a manufacturer in Canada to be familiarized with analysis software to analyze data from DFDRs in preparation for future investigations.

Column

Interaction with accident investigation authorities in other counteries

International Affairs Office

In April 2018, JTSB made a reorganization to deal with operations involving international coordination/cooperation and newly the “International Affairs Office” was established under the General Affairs Division. The major purpose of this reorganization is to reinforce the capacity to establish cooperation systems with related parties inside and outside Japan in case of an accident and respond to changes in the international rules, since Japan will assume additional international roles and responsibilities as the state of design/manufacture due to the development of domestic jet passenger aircraft.

In particular, close cooperation with accident investigation authorities of concerned countries is required for investigations. For this reason, JTSB is working to further enhance collaboration and promote exchanges with accident investigation authorities of foreign countries, so as to prepare a system allowing both parties to promptly and smoothly start and proceed with investigations and to share information regarding various accidents and investigation methods/lessons, thereby contributing to worldwide accident recurrence prevention.

○ Safety Investigation Authority of Finland

On October 9, 2018, JTSB and the Safety Investigation Authority (SIA) of Finland signed the Statement of Intent regarding aircraft accident/incident investigation.

Against the backdrop of increasing air traffic between Japan and Finland, this Statement of Intent aims to confirm that the accident investigation authorities of both countries will cooperate with each other to ensure aviation security. It is expected that the State of Intent will facilitate speedier and smoother accident investigations if an aircraft accident or incident involving both countries occurs, thereby contributing to improved aviation security.

○ French Bureau of Enquiry and Analysis for Civil Aviation Safety

On October 10 and 11, 2018, JTSB visited the French Bureau of Enquiry and Analysis for Civil Aviation Safety (BEA) to exchange opinions on accident investigations and took a tour of the facilities.

In 2002, JTSB (then Aircraft and Railway Accidents Investigation Commission) and BEA signed the State of Intent regarding aircraft

accident/incident investigations. Since then, staff members of both authorities have visited each other to exchange opinions regarding accident investigations.

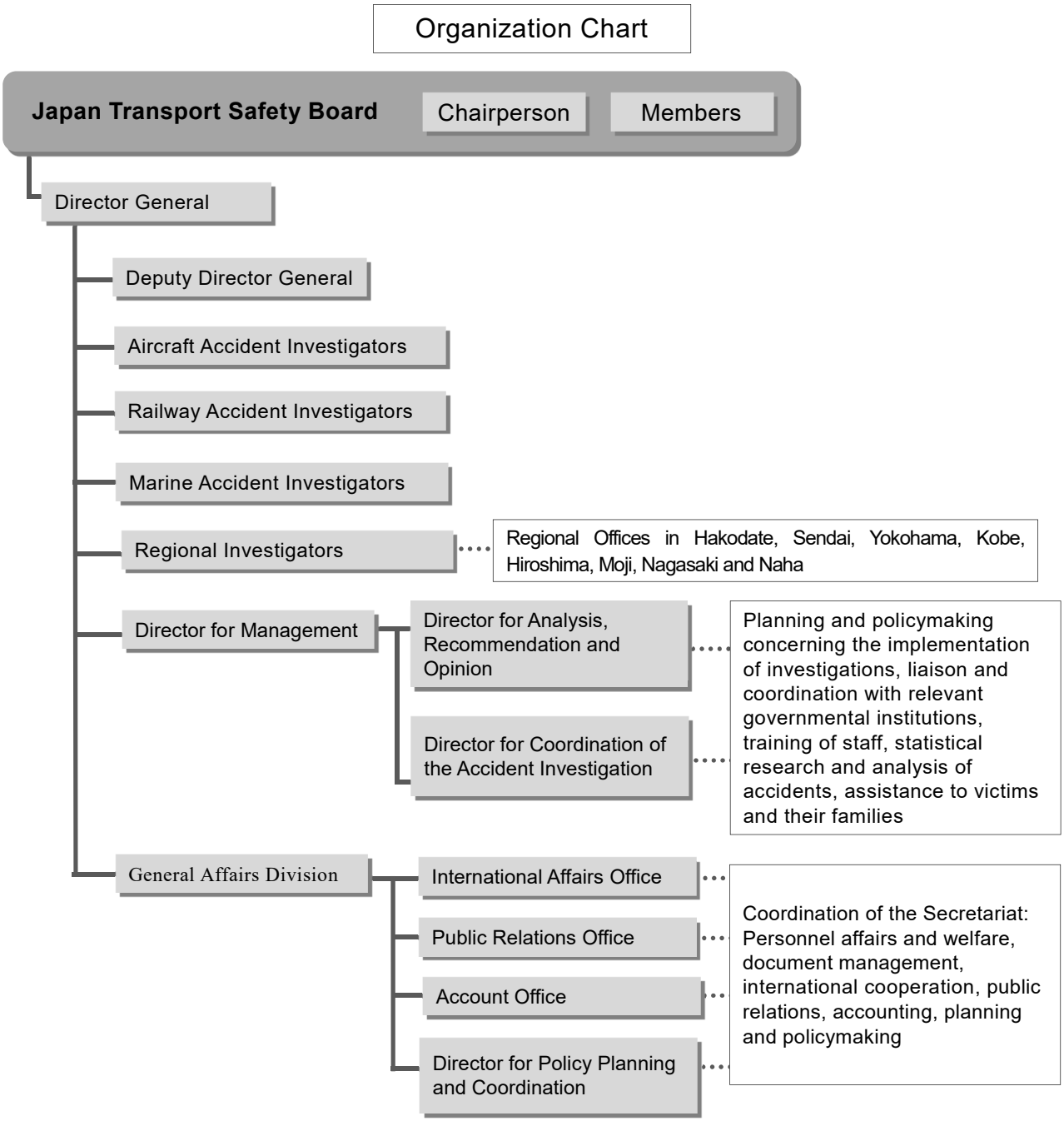
In the future, Japan will assume additional international responsibilities as the state of design/manufacture of domestic jet passenger aircraft. Since BEA has significant experience as the accident investigation authority of the state of design/manufacture in aircraft accidents involving Airbus, etc., JTSB gained knowledge on the activities and know-how as the state of design/manufacture and promoted exchange.

Appendixes

Appendixes

1 Outline of the organization

The Japan Transport Safety Board consists of the Chairperson, 12 members, and 178 secretariat staff (as of the end of March 2018). The staff in the secretariat consist of investigators who conduct investigations of aircraft, railway and marine accidents; the General Affairs Division that performs coordination-related jobs for the secretariat; and the Director for Management who is dedicated to the support and statistical analysis of accident investigations, and international cooperation. In addition, special support staff and local investigators are stationed at eight regional offices around the country (Hakodate, Sendai, Yokohama, Kobe, Hiroshima, Moji, Nagasaki and Naha). These local investigators investigate marine accidents (excluding serious ones) and support staff provide initial support for aircraft, railway and marine accidents.



2 Deliberation items of Board and each Committee

When investigations of accidents have progressed and the facts, as well as the causes and factors of accidents, have become clear to a certain extent, accident investigators put these results together and prepare a draft investigation report. This draft is then deliberated in the Board or Committees. As indicated in the table below, matters related to extremely serious accidents are deliberated in the Board, and matters related to particularly serious accidents are deliberated in the General Committee, and so nearly all draft investigation reports are deliberated in committees set up for each transport mode (Aircraft, Railway, Marine and Marine Special Committees).

The Board is composed of eight full-time members, including the Chairperson, and five part-time members, with its assemblies convened by the Chairperson. The Committees are composed of members with expertise related to each Committee, and their meetings are convened by their own Committee Directors. Any matters shall be decided by a majority of the members present for both the Board and Committees, and for both of these, a meeting cannot be convened and a decision cannot be made unless more than half of the members are present.

The Board (Committee) meeting is also attended by the Director General, Deputy Director General, Director for Management, Investigators concerned from the Secretariat.

Deliberation items of Board and each Committee

Board and Committees	Matters to be deliberated
Board	・Matters that the Board considers as extremely serious accidents based on the scale of damage and other matters including social impact
General Committee	・Matters related to particularly serious accidents (i) An accident involving ten or more persons killed or missing (ii) An accident involving twenty or more persons killed, missing or seriously injured (With regard to aircraft accidents and a marine accidents, (i) and (ii) are limited to passenger transport services.) ・Any other matters deemed to be necessary by the Board
Aircraft Committee	・Matters related to aircraft accidents and aircraft serious incidents (excluding the accidents to be handled by the General Committee)
Railway Committee	・Matters related to railway accidents and railway serious incidents (excluding the accidents to be handled by the General Committee)
Marine Committee	・Matters related to marine accidents and marine incidents as may be deemed serious by the Board (excluding the accidents to be handled by the General Committee and the Marine Special Committee)
Marine Special Committee	・Matters related to marine accidents and marine incidents (excluding the accidents to be handled by the General Committee and the Marine Committee)

3 Board Members

As of April 1, 2019

TAKEDA Nobuo, Chairperson (Full-time), Director of Aircraft Committee

TAKEDA Nobuo was appointed as Chairperson of the Japan Transport Safety Board on April 1, 2019; belongs to the Aircraft Committee, the Railway Committee and the Marine Committee with special expertise in aerospace engineering, strength of materials and composite materials engineering.

Career summary: PhD, University of Florida and D. Engr, the University of Tokyo
Emeritus Professor, Former Vice President, the University of Tokyo
Former Technical Advisor in Structures and Advanced Composite Research Unit, Aeronautical Technology Directorate of the Japan Aerospace Exploration Agency (JAXA)

KAKISHIMA Yoshiko, Member (Full-time)

KAKISHIMA Yoshiko was appointed as a member on April 1, 2019; belongs to the Aircraft Committee, the Railway Committee and the Marine Committee, with special expertise in Anglo-American law and others.

Career summary: Graduated from the Department of Law, the University of Tokyo
LL.M., Harvard Law School
Emeritus Professor, the University of Tokyo

MIYASHITA Toru, Member (Full-time), Vice-Chairperson, Deputy Director of Aircraft Committee

MIYASHITA Toru was appointed as a member on February 27, 2016; belongs to the Aircraft Committee, with special expertise in operation and maintenance of aircraft.

Career summary: Graduated from the Department of Aeronautics, Faculty of Engineering, the University of Tokyo
Former Executive Director of the Association of Air Transport Engineering & Research

MARUI Yuichi, Member (Full-time)

MARUI Yuichi was appointed as a member on December 6, 2016; belongs to the Aircraft Committee, with special expertise in maneuvering of aircraft.

Career summary: Graduated from Civil Aviation College
Former D.Senior Vice President, Corporate Safety and Security, All Nippon Airways Co., Ltd.

OKUMURA Fuminao, Member (Full-time), Director of Railway Committee

OKUMURA Fuminao was appointed as a member on December 6, 2016; belongs to the Railway Committee, with special expertise in railway engineering and geotechnical engineering.

Career summary: Doctor of Engineering, graduated from the Department of Civil Engineering, Faculty of Engineering, Tokyo Institute of Technology
Former Executive Director of the Railway Technical Research Institute

ISHIDA Hiroaki, Member (Full-time), Deputy Director of Railway Committee

ISHIDA Hiroaki was appointed as a member on December 26, 2016; belongs to the Railway Committee, with special expertise in dynamics of machinery, vehicle dynamics and railway vehicle engineering.

Career summary: Doctor of Engineering, graduated from the Department of Industrial Mechanical Engineering, Faculty of Engineering, the University of Tokyo
Former Professor in the Program in Mechanical Engineering, Department of Interdisciplinary Science and Engineering, School of Science and Engineering, Meisei University

SATO Yuji, Member (Full-time), Director of Marine Committee

SATO Yuji was appointed as a member on October 1, 2017; belongs to the Marine Committee and the Marine Special Committee, with special expertise in ship operation and maritime traffic safety.

Career summary: Graduated from Japan Coast Guard Academy
Former Commandant of Japan Coast Guard
Former President of Japan Coast Guard Foundation

TAMURA Kenkichi, Member (Full-time), Deputy Director of Marine Committee

TAMURA Kenkichi was appointed as a member on October 1, 2017; belongs to the Marine Committee and the Marine Special Committee, with special expertise in naval architect.

Career summary: Doctor of Engineering, Graduate School of Engineering, the University of Tokyo
Former Senior Director for Research of National Maritime Research Institute, National Institute of Maritime, Port and Aviation Technology

MIYAZAWA Yoshikazu, Member (Part-time)

MIYAZAWA Yoshikazu was appointed as a member on April 1, 2019; belongs to the Aircraft Committee, with special expertise in flight dynamics of aircraft, guidance and control.

Career summary: Doctor of Engineering, Graduate School of Engineering, the University of Tokyo
Emeritus Professor in Kyushu University
Contract Researcher in Electronic Navigation Research Institute

NAKANISHI Miwa, Member (Part-time)

NAKANISHI Miwa was appointed as a member on February 27, 2016; belongs to the Aircraft Committee, with special expertise in ergonomics (human factors).

Career summary: Doctor of Engineering, School of Science for Open and Environmental Systems, Graduate School of Science and Technology, Keio University
Associate Professor in the Department of Administration Engineering, Faculty of Science and Technology, Keio University (current post)

OKAMURA Miyoshi, Member (Part-time)

OKAMURA Miyoshi was appointed as a member on December 6, 2010; currently in the third term of office; belongs to the Railway Committee, with special expertise in structural engineering, earthquake engineering and maintenance management engineering (steel structure engineering).

Career Summary: Doctor of Engineering, Graduate School of Engineering, University of Yamanashi
Associate Professor in the Department of Research, Interdisciplinary Graduate School of Medicine and Engineering, University of Yamanashi (current post)

DOI Miwako, Member (Part-time)

DOI Miwako was appointed as a member on December 6, 2016; belongs to the Railway Committee, with special expertise in electrical engineering and traffic management (human interface).

Career Summary: Doctor of Philosophy
Auditor, National Institute of Information and Communications Technology
Executive Director, Nara Institute of Science and Technology

OKAMOTO Makiko, Member (Part-time)

OKAMOTO Makiko was appointed as a member on October 1, 2017; belongs to the Marine Committee and the Marine Special Committee, with special expertise in safety ergonomics.

Career Summary: Doctor of Human Sciences, Graduate School of Human Sciences, Waseda University
Lawyer
Associate Professor in the Faculty of Societal Safety Science, Kansai University (current post)

The chairperson and members of the Board shall be appointed by the Minister of Land, Infrastructure, Transport and Tourism with the consent of both houses of Representatives and Councilors.

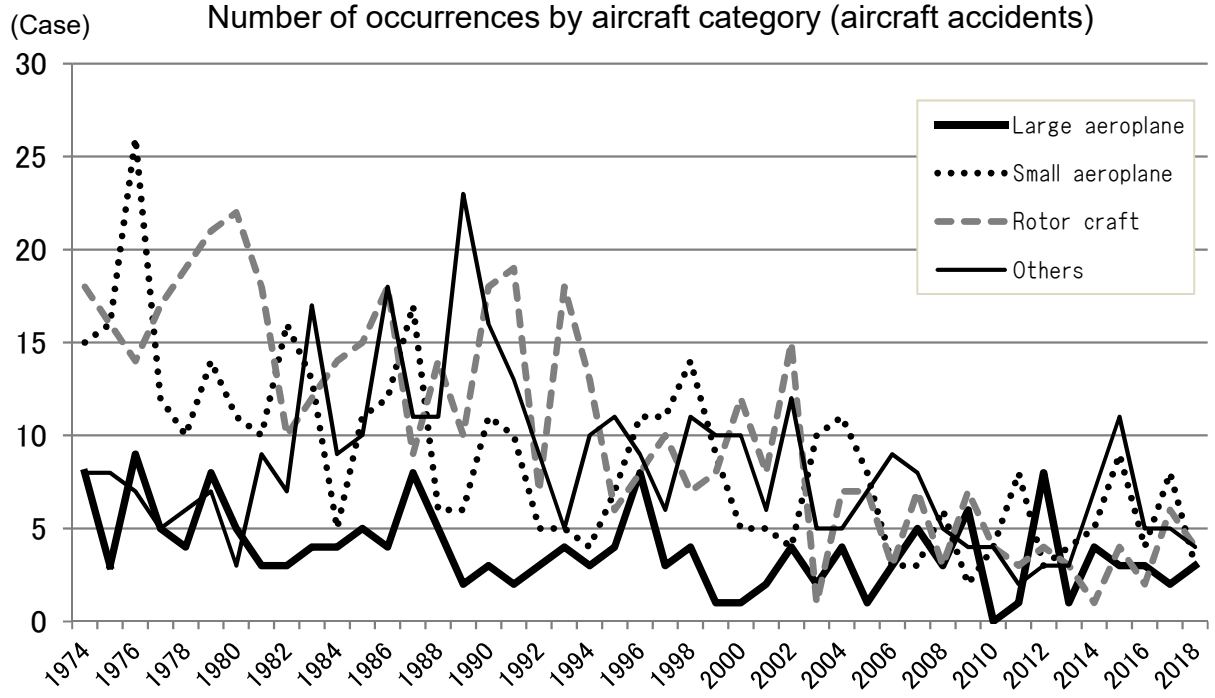
4 Number of occurrences by aircraft category (aircraft accidents)

(Cases)

Category / Year of occurrence	Aircraft			Rotor craft		Glider	Airship	Total
	Large aeroplane	Small aeroplane	Ultralight plane	Helicopter	Gyroplane			
1974	8	15	0	17	1	8	0	49
1975	3	16	0	16	0	8	0	43
1976	9	26	0	14	0	7	0	56
1977	5	12	0	16	1	5	0	39
1978	4	10	0	18	1	6	0	39
1979	8	14	0	20	1	6	1	50
1980	5	11	0	22	0	3	0	41
1981	3	10	1	18	0	8	0	40
1982	3	16	0	9	1	7	0	36
1983	4	13	10	12	0	7	0	46
1984	4	5	6	13	1	3	0	32
1985	5	11	6	15	0	4	0	41
1986	4	12	14	15	3	4	0	52
1987	8	17	8	8	1	3	0	45
1988	5	6	7	12	2	3	1	36
1989	2	6	11	9	1	12	0	41
1990	3	11	9	16	2	7	0	48
1991	2	10	6	19	0	7	0	44
1992	3	5	5	7	0	4	0	24
1993	4	5	3	17	1	2	0	32
1994	3	4	8	13	0	2	0	30
1995	4	7	10	6	0	1	0	28
1996	8	11	5	8	0	4	0	36
1997	3	11	3	8	2	3	0	30
1998	4	14	5	6	1	6	0	36
1999	1	9	5	7	1	5	0	28
2000	1	5	5	11	1	5	0	28
2001	2	5	2	8	0	4	0	21
2002	4	4	5	15	0	7	0	35
2003	2	10	3	1	0	2	0	18
2004	4	11	2	6	1	3	0	27
2005	1	8	0	7	0	7	0	23
2006	3	3	4	2	1	5	0	18

Category / Year of occurrence	Aircraft			Rotor craft		Glider	Airship	Total
	Large aeroplane	Small aeroplane	Ultralight plane	Helicopter	Gyroplane			
2007	5	3	4	7	0	4	0	23
2008	3	6	2	3	0	3	0	17
2009	6	2	1	7	0	3	0	19
2010	0	4	2	4	0	2	0	12
2011	1	8	1	3	0	1	0	14
2012	8	3	2	4	0	1	0	18
2013	1	4	1	3	0	2	0	11
2014	4	5	2	1	0	5	0	17
2015	3	9	3	3	1	8	0	27
2016	3	4	1	2	0	4	0	14
2017	2	8	3	5	1	2	0	21
2018	3	3	4	3	0	1	0	14
Total	171	392	169	436	25	204	2	1,399

(Note) 1. The figures include the cases handled by the Aircraft and Railway Accidents Investigation Commission.
2. Large aeroplanes are aircraft with a maximum take-off weight of more than 5,700kg.
3. Small aeroplanes are aircraft with a maximum take-off weight of 5,700kg or less, excluding Ultralight planes.
4. Ultralight planes include self-made, ultralight plane-shaped aircraft.
5. Gyroplanes include self-made, gyroplane-shaped aircraft.



5 Number of fatalities in accidents (aircraft accidents)

(Persons)

Year of occurrence \ Category		Large aeroplane	Small aeroplane	Ultralight plane	Helicopter	Gyroplane	Glider	Total	
2008	Crew	0	1	1	2	0	1	5	5
	Passengers and others	0	0	0	0	0	0	0	
2009	Crew	2	0	2	5	0	0	9	9
	Passengers and others	0	0	0	0	0	0	0	
2010	Crew	0	2	1	14	0	0	17	17
	Passengers and others	0	0	0	0	0	0	0	
2011	Crew	0	5	0	1	0	0	6	6
	Passengers and others	0	0	0	0	0	0	0	
2012	Crew	0	0	0	0	0	0	0	1
	Passengers and others	0	1	0	0	0	0	1	
2013	Crew	0	0	0	0	0	1	1	2
	Passengers and others	0	0	0	0	0	1	1	
2014	Crew	0	1	0	0	0	0	1	2
	Passengers and others	0	1	0	0	0	0	1	
2015	Crew	0	1	1	2	0	1	5	10
	Passengers and others	0	2	1	2	0	0	5	
2016	Crew	0	1	0	0	0	3	4	8
	Passengers and others	0	3	0	0	0	1	4	
2017	Crew	0	2	0	2	1	1	6	22
	Passengers and others	0	4	0	12	0	0	16	
2018	Crew	0	0	2	1	0	0	3	11
	Passengers and others	0	0	0	8	0	0	8	
	Crew	2	13	7	27	1	7	57	93
	Passengers and others	0	11	1	22	0	2	36	
	Total	2	24	8	49	1	9		

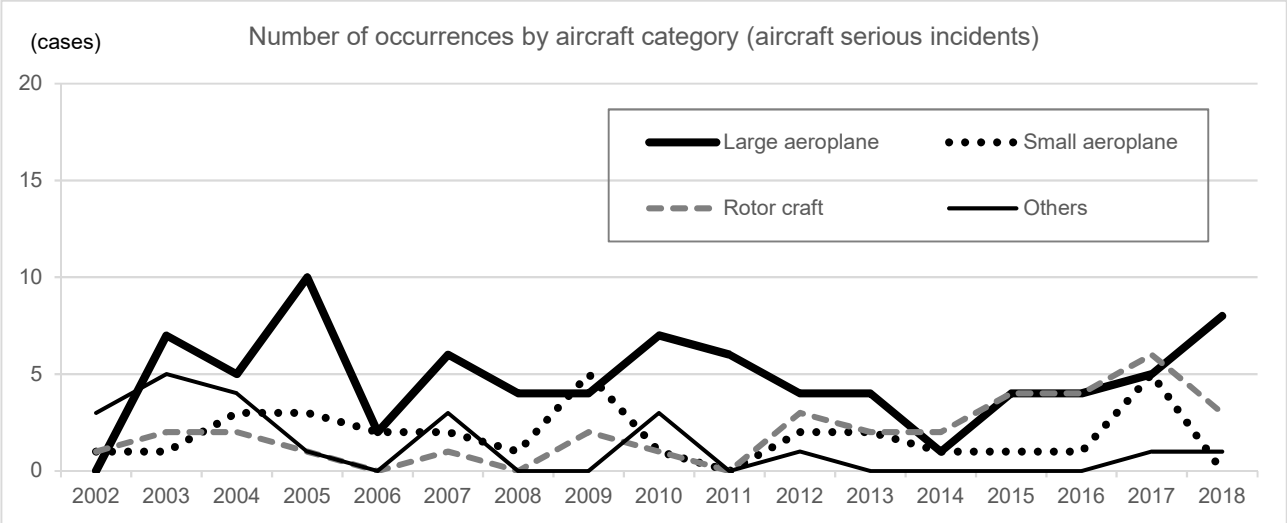
(Note) 1. The figures include the cases handled by the Aircraft and Railway Accidents Investigation Commission in 2008
2. Death tolls represent data for the respective years of occurrence relisted from the annual reports published for those years.
3. Large aeroplanes are aircraft with a maximum take-off weight of more than 5,700kg.
4. Small aeroplanes are aircraft with a maximum take-off weight of 5,700kg or less, excluding Ultralight planes.
5. Ultralight planes include self-made, ultralight plane-shaped aircraft.
6. Gyroplanes include self-made, gyroplane-shaped aircraft.

6 Number of occurrences by aircraft category (aircraft serious incidents)

(Cases)

Category / Year of occurrence	Aircraft			Rotor craft		Glider	Airship	Total
	Large aeroplane	Small aeroplane	Ultralight plane	Helicopter	Gyroplane			
2001	3	0	0	0	0	0	0	3
2002	0	1	2	1	0	1	0	5
2003	7	1	4	2	0	1	0	15
2004	5	3	4	2	0	0	0	14
2005	10	3	1	1	0	0	0	15
2006	2	2	0	0	0	0	0	4
2007	6	2	2	1	0	1	0	12
2008	4	1	0	0	0	0	0	5
2009	4	5	0	2	0	0	0	11
2010	7	1	3	1	0	0	0	12
2011	6	0	0	0	0	0	0	6
2012	4	2	0	3	0	1	0	10
2013	4	2	0	2	0	0	0	8
2014	1	1	0	2	0	0	0	4
2015	4	1	0	4	0	0	0	9
2016	4	1	0	4	0	0	0	9
2017	5	5	0	6	0	1	0	17
2018	8	0	0	3	0	1	0	12
Total	84	31	16	34	0	6	0	171

(Note) 1. The figures include the cases handled by the Aircraft and Railway Accidents Investigation Commission. The number of cases for 2001 represents those that occurred from October onward.
2. Large aeroplanes are aircraft with a maximum take-off weight of more than 5,700kg.
3. Small aeroplanes are aircraft with a maximum take-off weight of 5,700kg or less, excluding Ultralight planes.
4. Ultralight planes include self-made, ultralight plane-shaped aircraft.



7 Number of occurrences by type (railway accidents)

(Cases)

Year of occurrence \ Type	Railway							Tramway							Total
	Train collision	Train derailment	Train fire	Level crossing accident	Accident against road traffic	Other accidents with casualties	Heavy property loss without casualties	Vehicle collision	Vehicle derailment	Vehicle fire	Level crossing accident	Accident against road traffic	Other accidents with casualties	Heavy property loss without casualties	
2001	0	4	1	0	0	0	0	0	0	0	0	0	0	0	5
2002	1	14	1	2	0	1	1	0	0	0	0	0	0	0	20
2003	1	20	2	0	0	0	0	0	0	0	0	0	0	0	23
2004	0	18	0	1	0	0	0	0	1	0	0	0	0	0	20
2005	2	20	0	0	0	1	0	0	1	0	0	0	0	0	24
2006	1	13	0	1	0	0	0	1	0	0	0	0	0	0	16
2007	0	12	2	3	0	0	0	0	2	0	0	0	0	0	19
2008	0	7	2	2	0	1	1	0	0	0	0	0	0	0	13
2009	0	5	1	2	0	3	0	0	0	0	0	0	0	0	11
2010	0	6	0	0	0	1	0	0	0	0	0	2	0	0	9
2011	0	12	0	1	0	1	0	0	0	0	0	0	0	0	14
2012	0	13	2	0	0	2	0	0	2	0	0	1	0	0	20
2013	0	11	1	1	0	1	0	0	1	0	0	0	0	0	15
2014	1	9	0	4	0	0	0	0	0	0	0	0	0	0	14
2015	1	5	1	4	0	1	0	0	1	0	0	0	0	0	13
2016	0	7	0	15	0	0	0	0	1	0	0	0	0	0	23
2017	0	9	0	7	0	2	1	0	0	0	0	0	0	0	19
2018	0	2	0	9	0	0	0	0	0	0	0	0	0	0	11
Total	7	187	13	52	0	14	3	1	9	0	0	3	0	0	289

(Note) 1. The figures include the cases handled by the Aircraft and Railway Accidents Investigation Commission.
2. The number of cases for 2001 represents those that occurred from October onward.

8 Number of fatalities in accidents (railway accidents)

(Persons)

Year of occurrence \ Death Classification	crew members	Passengers	Others	Total
2008	0	0	2	2
2009	0	0	3	3
2010	0	0	2	2
2011	0	0	1	1

Death Classification / Year of occurrence	crew members	Passengers	Others	Total
2012	0	0	1	1
2013	0	0	1	1
2014	0	0	6	6
2015	0	2	4	6
2016	0	0	15	15
2017	0	0	10	10
2018	0	0	9	9
Total	0	2	54	56

(Note) 1. The figures include the cases handled by the Aircraft and Railway Accident Investigation Commission in 2008
2. Dealt tolls represent data for the respective years of occurrence relisted from the annual reports published for those years.
3. As investigations began to cover fatal accidents at third- and fourth-class crossings without crossing gates in April 2014, the number of deaths occurring in those locations were added.

9 Number of occurrences by type (railway serious incidents)

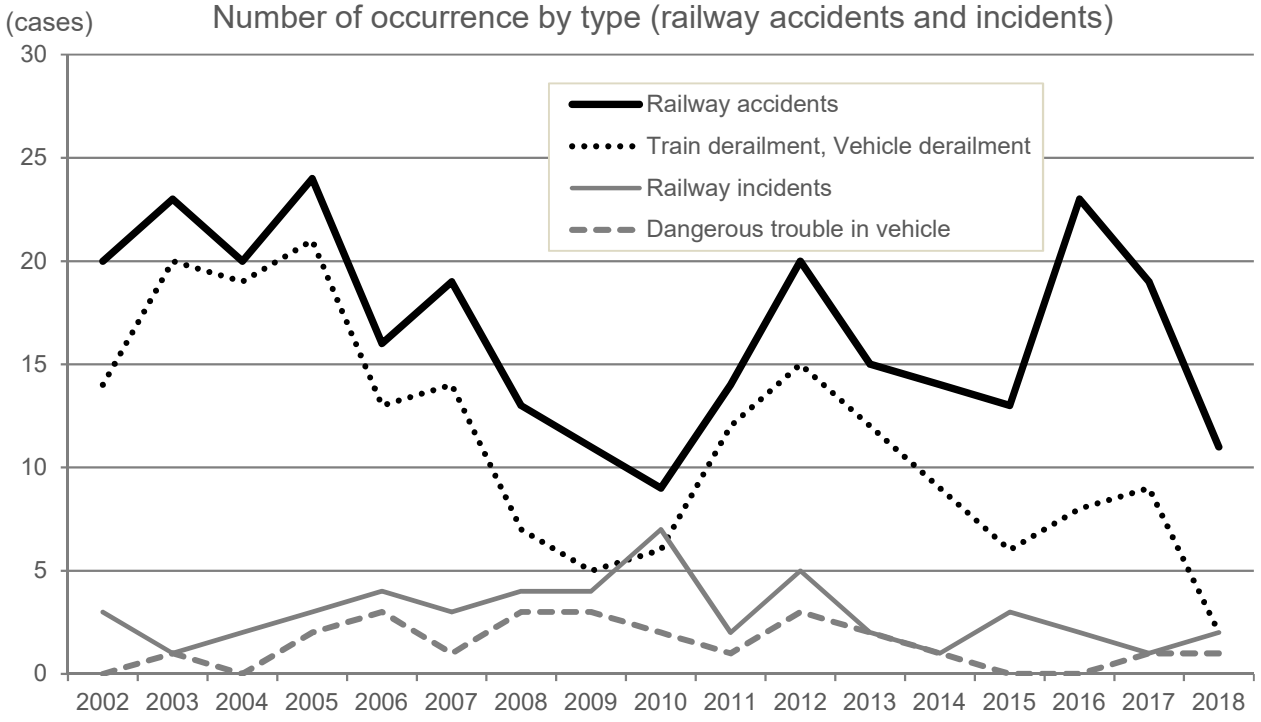
(Cases)

Type / Year of occurrence	Railway										Tramway							Total
	Incorrect management of safety block	Incorrect indication of signal	Violating red signal	Main track overrun	Violating closure section for construction	Vehicle derailment	Dangerous damage in facilities	Dangerous trouble in vehicle	Heavy leakage of dangerous object	Others	Incorrect management of safety block	Violating red signal	Main track overrun	Dangerous damage in facilities	Dangerous trouble in vehicle	Heavy leakage of dangerous object	Others	
2001	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2002	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
2003	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2004	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
2005	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
2006	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	4
2007	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	3
2008	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	4
2009	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	4
2010	1	0	0	0	1	1	0	2	0	0	1	1	0	0	0	0	0	7
2011	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
2012	0	0	0	0	1	1	0	3	0	0	0	0	0	0	0	0	0	5
2013	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
2014	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

Year of occurrence \ Type	Railway										Tramway							Total
	Incorrect management of safety block	Incorrect indication of signal	Violating red signal	Main track overrun	Violating closure section for construction	Vehicle derailment	Dangerous damage in facilities	Dangerous trouble in vehicle	Heavy leakage of dangerous object	Others	Incorrect management of safety block	Violating red signal	Main track overrun	Dangerous damage in facilities	Dangerous trouble in vehicle	Heavy leakage of dangerous object	Others	
2015	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3
2016	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
2017	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2018	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
Total	1	7	0	0	7	2	3	24	0	3	2	1	0	0	0	0	0	50

(Note) 1. The figures include the cases handled by the Aircraft and Railway Accidents Investigation Commission.

2. The number of cases for 2001 represents those that occurred from October onward.



10 Number of occurrences by area (marine accidents and incidents)

(Cases)

Year \ Area	In Japanese waters			Outside Japanese waters	Total
	In ports specified by the Cabinet Order	Within 12 nautical miles	In lakes or rivers		
2007	0	3	0	0	3
2008	227	576	15	55	873

Year \ Area	In Japanese waters			Outside Japanese waters	Total
	In ports specified by the Cabinet Order	Within 12 nautical miles	In lakes or rivers		
2009	341	1,065	34	82	1,522
2010	308	906	38	82	1,334
2011	239	780	28	79	1,126
2012	227	804	31	53	1,115
2013	215	763	35	69	1,082
2014	193	762	31	44	1,030
2015	154	674	43	39	910
2016	147	637	42	23	849
2017	155	663	35	42	895
2018	186	668	38	49	941
Total	2,391	8,307	370	622	11,690

(Note) The above table shows the number of accidents and incidents into which the JTSB launched an investigation as of the end of February 2019 (including those carried over from the former Marine Accident Inquiry Agency).

11 Number of occurrences by type (marine accidents and incidents)

(Cases)

Year \ Type	Marine accident											Marine incident				Total
	Collision	Contact	Grounding	Sinking	Flooding	Capsizing	Fire	Explosion	Facility damage	Fatality/Injury	Others	Loss of control	Stranded	Safety obstruction	Navigation obstruction	
2007	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
2008	181	101	255	12	4	28	15	3	30	61	0	54	34	8	87	873
2009	325	174	431	16	19	58	42	3	38	217	2	105	33	0	59	1,522
2010	356	180	369	15	18	50	35	2	26	146	0	83	16	0	38	1,334
2011	282	145	265	12	18	56	32	1	23	142	1	103	10	1	35	1,126
2012	246	133	264	5	21	55	44	2	33	155	0	113	5	4	35	1,115
2013	264	145	210	10	25	49	33	2	38	163	2	106	7	3	25	1,082
2014	265	116	213	7	11	61	35	1	37	150	3	92	15	0	24	1,030
2015	244	102	202	5	12	56	38	3	20	122	1	85	4	4	12	910
2016	217	94	163	5	19	46	26	3	21	144	0	85	6	6	14	849
2017	200	96	181	14	22	55	27	3	23	142	0	115	4	3	20	905
2018	239	88	164	20	26	51	24	2	23	179	0	105	11	0	9	941
Total	2,819	1,375	2,719	121	195	565	351	25	312	1,621	9	1,046	145	29	358	11,690

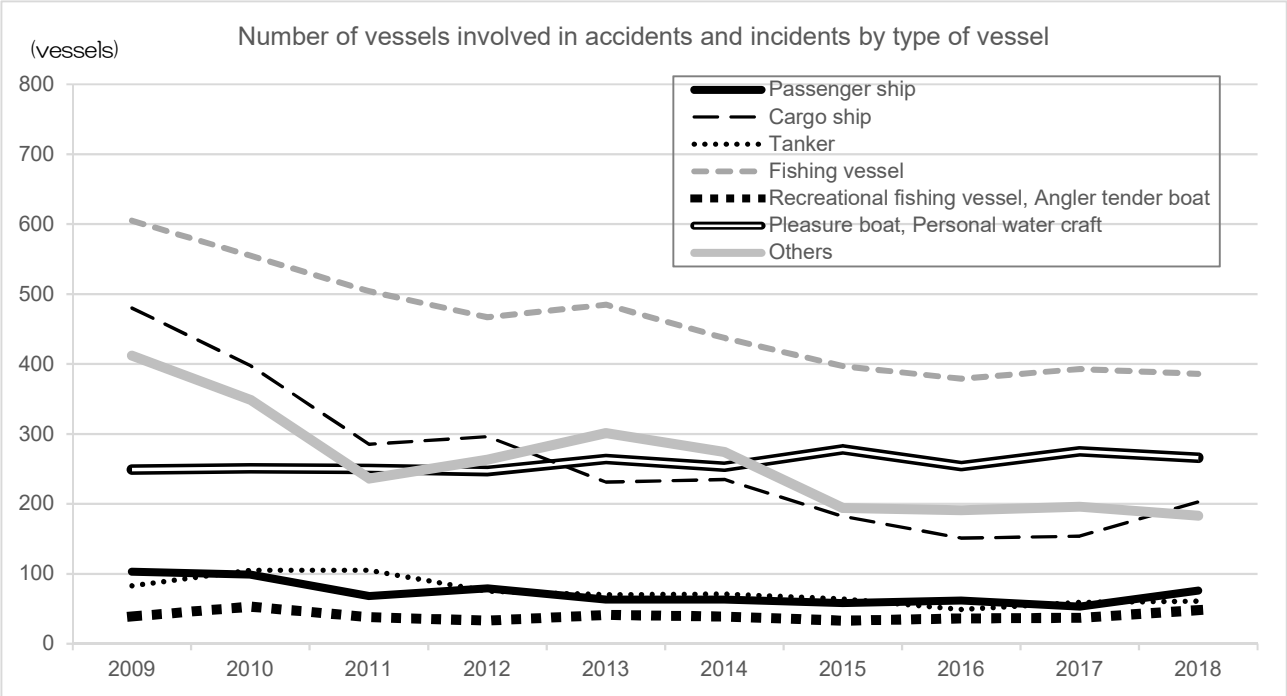
(Note) 1. The above table shows the number of accidents and incidents into which the JTSB launched an investigation as of the end of February 2019 (including those carried over from the former Marine Accident Inquiry Agency).
2. The figures in the column “Fatality/Injury” are the number of cases involving death, death and injury, missing persons, or injury which is not a result from other types of accident.

12 Number of vessels involved in accidents and incidents by type of vessel (marine accidents and incidents)

(Cases)

Type of Vessel / Year	Passenger ship	Cargo ship	Tanker	Fishing vessel	Tug boat, push boat	Recreational fishing vessel	Angler tender boat	Work vessel	Barge, Lighter	Public-service ship	Pleasure boat	Personal water craft	Others	Total
2007	2	1	0	0	0	0	0	0	0	0	0	0	0	3
2008	55	318	55	307	98	28	6	27	60	11	125	31	7	1,128
2009	103	480	83	605	163	39	5	35	104	40	249	65	23	1,994
2010	99	398	105	555	123	53	6	48	82	24	251	66	18	1,828
2011	68	285	105	504	89	38	6	29	50	16	250	46	21	1,507
2012	79	296	75	467	91	33	8	36	59	14	247	55	8	1,468
2013	63	231	70	485	100	41	4	37	72	24	264	64	18	1,473
2014	63	235	71	437	89	39	5	36	58	17	253	69	14	1,386
2015	58	182	64	397	53	33	7	27	45	14	278	48	10	1,216
2016	62	151	49	379	45	36	7	27	33	11	254	68	6	1,128
2017	53	154	59	393	62	37	3	32	45	12	275	42	8	1,175
2018	76	203	61	386	50	48	7	20	35	15	266	56	10	1,233
Total	781	2,934	797	4,915	963	425	64	354	643	198	2,712	610	143	15,539

(Note) The above table shows the number of vessels involved in accidents and incidents into which the JTSB launched an investigation as of the end of February 2019 (including those carried over from the former Marine Accident Inquiry Agency).



13 Number of vessels involved in accidents and incidents by gross tonnage (marine accidents and incidents)

(Vessels)

Gross tonnage / Year	less than 20 tons	20 to less than 100 tons	100 to less than 200 tons	200 to less than 500 tons	500 to less than 1,600 tons	1,600 to less than 3,000 tons	3,000 to less than 5,000 tons	5,000 to less than 10,000 tons	10,000 to less than 30,000 tons	More than 30,000 tons	Unknown	Total
2007	1	0	0	1	0	0	0	0	0	0	1	3
2008	485	52	138	216	77	24	16	17	10	15	78	1,128
2009	903	89	230	288	116	42	34	49	30	14	199	1,994
2010	900	86	175	260	128	36	37	39	25	24	118	1,828
2011	823	59	142	194	101	39	18	32	21	17	61	1,507
2012	790	53	133	199	78	33	25	38	25	20	74	1,468
2013	881	44	113	142	93	47	27	36	19	17	54	1,473
2014	839	46	86	145	87	38	26	29	17	17	56	1,386
2015	762	43	66	112	65	32	18	27	22	19	50	1,216
2016	745	31	64	104	61	23	17	21	18	10	34	1,128
2017	755	39	80	115	70	24	14	22	17	6	33	1,175
2018	766	32	74	112	75	44	32	17	15	12	54	1,233
Total	8,650	574	1,301	1,888	951	382	264	327	219	171	812	15,539

(Note) The above table shows the number of vessels involved in accidents and incidents into which the JTSB launched an investigation as of the end of February 2019 (including those carried over from the former Marine Accident Inquiry Agency).

14 Number of vessels involved in accidents and incidents in 2018 by type of accident/incident and type of vessel (marine accidents and incidents)

(Vessels)

Type of accident/incident / Type of vessel	Marine accident											Marine incident				Total
	Collision	Contact	Grounding	Sinking	Flooding	Capsizing	Fire	Explosion	Facility damage	Fatality/ Injury	Others	Loss of control	Stranded	Safety obstruction	Navigation obstruction	
Passenger ship	18	21	12	1	1	1	1	0	0	7	0	8	0	0	6	76
Cargo ship	89	35	33	0	2	0	1	0	8	12	0	19	4	0	0	203
Tanker	26	8	10	0	1	0	2	1	1	2	0	8	1	0	1	61
Fishing vessel	168	7	42	6	10	18	11	1	7	88	0	27	1	0	0	386
Tug boat, push boat	17	6	13	1	0	1	0	0	1	7	0	3	1	0	0	50
Recreational fishing vessel	26	3	1	1	2	1	4	0	0	6	0	3	1	0	0	48
Angler tender boat	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	7
Work vessel	5	1	3	2	1	3	0	0	1	2	0	2	0	0	0	20
Barge, Lighter	13	4	8	0	0	2	0	0	2	4	0	1	1	0	0	35
Public-service ship	3	1	6	0	1	0	1	0	0	1	0	2	0	0	0	15
Pleasure boat	99	7	40	9	8	28	4	0	6	26	0	34	3	0	2	266
Personal water craft	18	0	2	0	0	0	0	0	0	36	0	0	0	0	0	56
Others	6	0	3	0	0	0	0	0	0	1	0	0	0	0	0	10
Total	493	93	175	20	26	54	24	2	26	192	0	107	12	0	9	1,233

(Note) 1. The above table shows the number of vessels involved in accidents and incidents into which the JTSB launched an investigation as of the end of February 2019.
2. The figures in the column “Fatality/Injury” are the number of cases involving death, death and injury, missing persons, or injury which is not a result from other types of accident.

15 Number of fatalities in accidents (marine accidents)

(Persons)

Year of occurrence / Type of Vessel		Passenger ship	Cargo ship	Tanker	Cargo ship	Recreational fishing vessel・Angler tender boat	Pleasure boat・Personal water craft	Others	Total	
2008	Crew	0	2	2	51	1	21	1	61	71
	Passengers	0	0	0	0	2	0	0	2	
	Others	0	0	0	0	1	6	1	8	

Year of occurrence \ Type of Vessel		Passenger ship	Cargo ship	Tanker	Cargo ship	Recreational fishing vessel・Angler tender boat	Pleasure boat・Personal water craft	Others	Total	
2009	Crew	3	1	2	109	0	26	4	145	191
	Passengers	0	0	0	0	3	0	0	3	
	Others	1	5	0	6	0	27	4	43	
2010	Crew	1	10	1	74	0	11	2	99	129
	Passengers	0	0	0	0	1	0	0	1	
	Others	0	3	0	1	1	22	2	29	
2011	Crew	3	4	8	83	3	18	7	126	146
	Passengers	4	0	0	0	2	0	0	6	
	Others	0	2	0	0	0	12	0	14	
2012	Crew	2	6	4	79	1	22	3	117	133
	Passengers	1	0	0	0	2	0	0	3	
	Others	1	1	0	1	0	8	2	13	
2013	Crew	1	17	2	69	0	19	6	114	134
	Passengers	0	0	0	0	1	0	0	1	
	Others	0	2	0	0	0	16	1	19	
2014	Crew	0	11	3	89	0	17	3	123	138
	Passengers	0	0	0	0	2	0	0	2	
	Others	0	1	1	1	0	10	0	13	
2015	Crew	3	5	0	44	0	12	5	69	87
	Passengers	2	0	0	0	2	0	0	4	
	Others	0	0	0	0	0	13	1	14	
2016	Crew	1	4	5	45	1	10	4	70	93
	Passengers	0	0	0	0	2	0	0	2	
	Others	0	2	0	2	0	15	2	21	
2017	Crew	2	4	0	45	0	8	20	79	92
	Passengers	0	0	0	0	0	0	0	0	
	Others	0	0	0	0	0	11	2	13	
2018	Crew	0	2	1	46	0	14	3	66	85
	Passengers	0	0	0	0	1	0	0	1	
	Others	1	0	1	0	0	14	2	18	
Total	Crew	16	66	27	734	6	162	58	1,002	1,299
	Passengers	7	0	0	0	18	0	0	24	
	Others	3	16	2	11	2	154	17	185	
	Total	26	82	29	745	26	316	75		

(Note) The above table shows the number of vessels involved in accidents and incidents into which the JTSB launched an investigation as of the end of February 2019 (including those carried over from the former Marine Accident Inquiry Agency).

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