Major activities in the past year

1. Investigating aircraft accidents using drones

The aviation field started aircraft accident investigations actively using drones.

Contracted private business operators have used drones for some accident investigations. It took them time to pre-arrange photographing points, etc. with relevant drone controllers and to conduct contract procedures. Thus, using drones in a timely manner has been an issue.

Photo 1. Drone of Japan Transport Safety Board

Now, compact and light weight drone (Photo 1) has been introduced which enables aerial photographing even in 4K. Because of this, accident investigators are able to pack such a drone in a bag to carry with them, fly the drone by themselves at the accident location, and take on-site images from the sky in a timely manner.

On-site photographingby drone has enabled investigators to easily grasp the distribution of wreckage by capturing a wide image of the site (see Photo 2), visually reveal the mark from a contact point to a stop position on a runway when landing, or depict a flight path of an airframe from a contact position to a crash location with an obstacle, etc. in three dimensions (see Photo 2). In addition, it is also possible to create three-dimensional digital images, which are called orthomosaic images, based on a series of images obtained through a programmed flight using photogrammetric software.

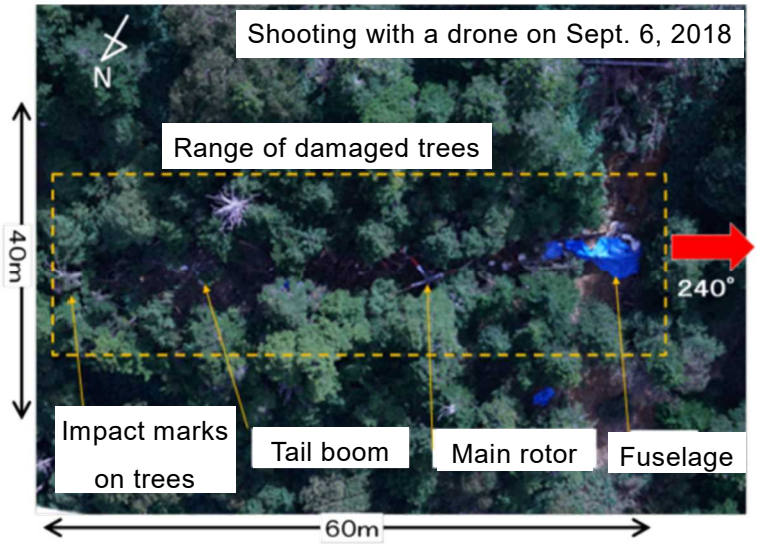


Photo 2. Distribution of wreckage and a trace up to the stop position

Although photographing from helicopters or other small airplanes is possible, drones enable easy, inexpensive, and speedy photographing with high accuracy from low altitudes without restrictions such as weather and the lowest flight altitude that aircrafts must comply with, excluding cases under rain and/or strong wind.

In accident investigations so far, investigators used measures, laser distance meters, or GPS receivers to conduct measuring and then create wreckage layout drawings, etc. by plotting positions on the drawings, but now investigators can measure highly-accurate positional relationships by using photographs by drones and their data.

To use drones in investigations, it is essential to learn how to control drones and photograph aerial

images in order to acquire qualifications. Acquiring such qualifications is on-going and various methods of photographing aerial images are being studied.

Thus, it is thought that using data obtained with drones enables more scientific analysis, and helps investigators make investigation reports more visually easy-to-understand than they are now. Moreover, investigators are putting more effort into using drones for accident investigations related to unmanned aircrafts planned to be implemented from the end of 2022.

2. Aircraft serious incident investigation report published regarding the front landing gear damaged of a passenger aircraft at landing

[Summary]

On Saturday, March 24, 2018, a passenger aircraft was forced to stop on the runway with its nose wheel turned sideways at about 90 degrees after landing at Fukuoka Airport. Consequently, the aircraft was unable to continue taxiing. (See Photo 1)

None of passengers were injured.

Photo 1. Serious incident aircraft
(at the time of the serious incident)

[Probable causes]

It is highly probable that the aircraft was unable to continue taxiing because during its landing roll, the Apex pin was disconnected, which is one of parts that link the crew's steering operations to the nose wheel, causing lost control of the nose wheel steering.

After the accident occurred, the pin was found on the runway, and it was revealed that the threads of the pin were damaged and corroded (see Photo 2). Because the damage and corrosion of the pin threads might have caused it to fall out, and other aircrafts of the same type might have similar potential troubles, the Japan Transport Safety Board provided information on the damage to the pin to the Civil Aviation Bureau. In response to the information, the Civil Aviation Bureau instructed business operators in Japan that operate aircrafts of the same type to inspect the concerned pins. As a result, a corroded pin was found on an aircraft of the same type, and thus, necessary measures were taken to prevent the pin from falling out, etc.

The accident investigation and analysis were carried out to determine the cause of the pin falling out, cooperating with the French aircraft accident investigating authority, the BEA (Bureau d'Enquêtes et d'Analyses: France is the State of Design and Manufacture of the aircraft). As a result, it was revealed that repeated pin installation and removal for inspection damaged the cadmium plating applied to the pin threads to prevent corrosion. Corrosion started and progressed in the damaged cadmium plating, subsequently the threads got damaged, and eventually the pin fell out. It was also revealed that inappropriate work at the contracted maintenance operator

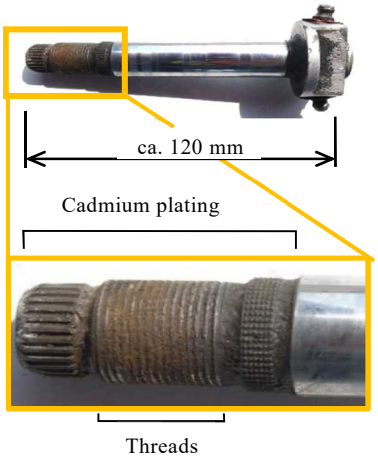


Photo 2. Apex pin

might have accelerated the corrosion progress.

Based on these investigation results, the aircraft manufacturer is to instruct aircraft operators to conduct periodic inspection of the pins concerned, additionally, the aircraft manufacturer is to take measures to prevent such recurrences by clarifying such as the maintenance manual, and developing pins with improved corrosion resistance as permanent measures (see Chapter 3 (page 45)).

3. Accident inspection report published on the automatically operated train

[Summary]

On June 1, 2019, the outbound train started from Shin-Sugita station bound for Namiki-Chuo station departed from Shin-Sugita station in the unmanned automatic operation, but the train moved to the inbound direction (running in the wrong direction) and collided with the car stop. 17 passengers were injured.

Wired status viewed from aisle side, broken in back side of the circled bundle of cables

[Probable causes]

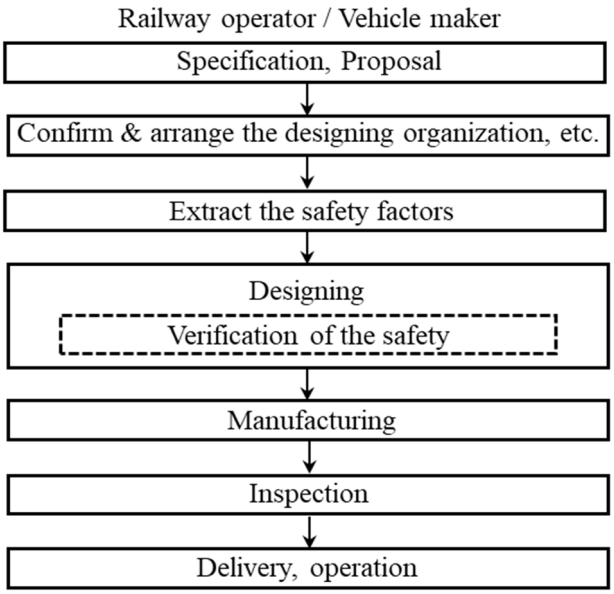
It is probable that the electric wire to convey the running direction in the Device Room of the train was broken, so the running direction did not change in the control device at the turn-back station. Therefore, the train ran in wrong direction, resulting in collision with the car stop.

As a background to this accident, it is likely that the latent causes for such dangerous incident were existed because the confirmation and the arrangement on the understandings for the designing organization, etc., and the extraction of items to be paid attention before designing between related parties the safety factors were not implemented sufficiently, in the designing and manufacturing process of the vehicle. In addition, it is probable that the existance of latent causes of the dangerous events was not noticed due to the insufficient verification of the safety during the design examination, etc.

In this investigation, in view of widely preventing accidents caused by the designing and manufacturing process of the vehicle as well as preventing the recurrence of the accident, analysis was conducted even on the background of the accident, such as factors resulted in the designing in which conditions led to the backward running were overlooked, and factors that made risk of the backward running not be noticed even during the design examination.

Based on the result, Japan Transport Safety Board has recommended establishing of the following stages regarding to the designing and manufacturing process to the Minister of Land, Infrastructure, Transport and Tourism: "confirm and arrange the designing organization, etc.", "extract safety factors", "verify the safety", for preparing the designing organization to implement the system integration, etc., and the thorough instruction provision to the railway and tramway operators and the manufacturers of the railway vehicles, etc., and has also provided opinions to the Minister of Land, Infrastructure, Transport and Tourism on considering the institutionalization of the details of the recommendations.

(For more details, see Chapter 2 (page 19 and page 24), Chapter 4 (page 70).)



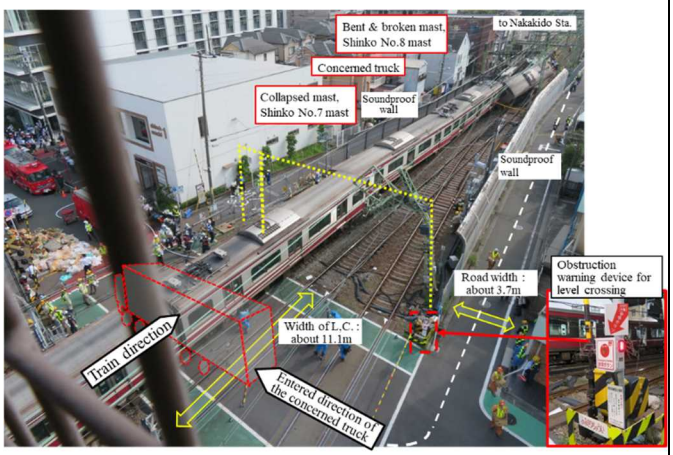
Design and manufacturing process

4. Accident investigation report published regarding derailment caused by collision between a train and truck

[Summary]

On September 5, 2019, the train started from Aoto station bound for Misakiguchi station collided with a truck and derailed at Kanagawa-shimmachi No.1 level crossing. In addition, the truck was wrecked and caught fire.

The Truck driver died, and 75 passengers, the Driver of the train, and the Conductor were injured.



Status of around the accident site

[Probable causes]

The JTSB concludes that the probable cause of this accident was certain that the truck entered the Level crossing and hindered the route of the train, and the train could not stop before the Level crossing although the obstruction warning signal of the Level crossing had been indicating the stop signal, then collided with the Truck.

In the investigation, analysis was conducted, focusing on how the truck entered the Level crossing and hindered the route of the train, and on the brake application after the stop signal for the train was indicated, and other factors.

As a result, it was revealed that it is likely that the Truck stayed in the Level crossing because it took a long time to pass through due to the narrow width of the road. In addition, it was revealed that the brake operation of the train involved with the installation position of the obstruction warning signal, obstructed view, and so on, delayed noticing of the stop signal of the obstruction warning signal, and the rules for handling the brake when the stop signal was indicated were not clearly stated, and so on.

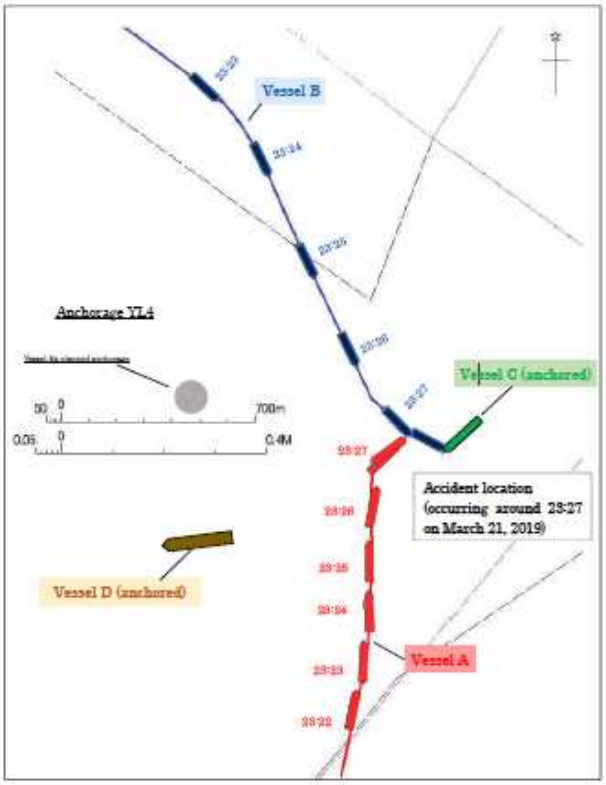
The accident investigation report published describes not only the analysis result above but also measures considered to be necessary for preventing the recurrence of such an accident, e.g., taking measures to prevent automobiles from wrongly entering narrow roads that are hard to pass, providing the appropriate number of obstruction warning signals at appropriate positions, and more (see Chapter 4 on page 73).

5. Collision accident inspection report published, involving three container ships

[Summary]

On March 21, 2019, the container ship (13,764 t) (Vessel A), proceeding north toward her planned anchorage within Anchorage YL4 of Yokohama Section 5, Keihin Port and the container ship (9,610 t) (Vessel B), proceeding south-southeast toward Nagoya Port, Aichi Prefecture collided in Anchorage YL4. Vessel B subsequently collided with the anchored container ship (18,252 t) (Vessel C).

None of passengers were injured.



Estimated navigation routes

[Probable causes]

It is probable that at night within an anchorage that had become confined with the presence of anchored Vessels, under conditions in which the courses of Vessel A and Vessel B intersected between anchored Vessel C and another anchored vessel, and the danger of collision was rising, Vessel A and Vessel B collided because Vessel A intended to pass Vessel B port-to-port and Vessel B intended to pass Vessel A starboard-to-starboard, and subsequently Vessel B collided with Vessel C.

In the investigation, analysis was conducted on the level of collision risk using multiple evaluation indicators based on records of both vessels' Automatic Identification Systems (AIS) in order to determine the timing of starting appropriate give-way vessel maneuvering while the level of collision risk was increasing at each time step before collision, and an appropriate standard of give-way method based on the positional relationship of vessels, and to clarify when and what kind of failure occurred in judgment made by both vessels' operators, comparing the timing and standard determined to those of actual vessels involved in the accident.

As a result, it was revealed that it is probable that Vessel A could have prevented the accident by taking such measures as promptly reducing speed, without expecting Vessel B to make a starboard turn, and Vessel B could have prevented the accident by taking such measures as promptly reducing speed, without attempting to navigate near Vessel A's bow.

Based on these investigation results, the Japan Transport Safety Board made safety recommendations to the management companies of Vessel A and Vessel B to instruct including the captains to take measures to avoid collision by promptly reducing speed, etc., while sufficient time is available after confirming maneuvering intentions with the other vessel by engaging in VHF

communication.

In addition, because the quantitative analysis method used in this investigation is advanced, the JTSB has been sharing the investigation method and analysis status internationally by introducing it at the chairperson meeting of the International Transportation Safety Association (ITSA) held in May 2021 and at other opportunities.

(For more details, see Chapter 2 (page 25), Chapter 5 (page 101), and Chapter 7 (page 142).)

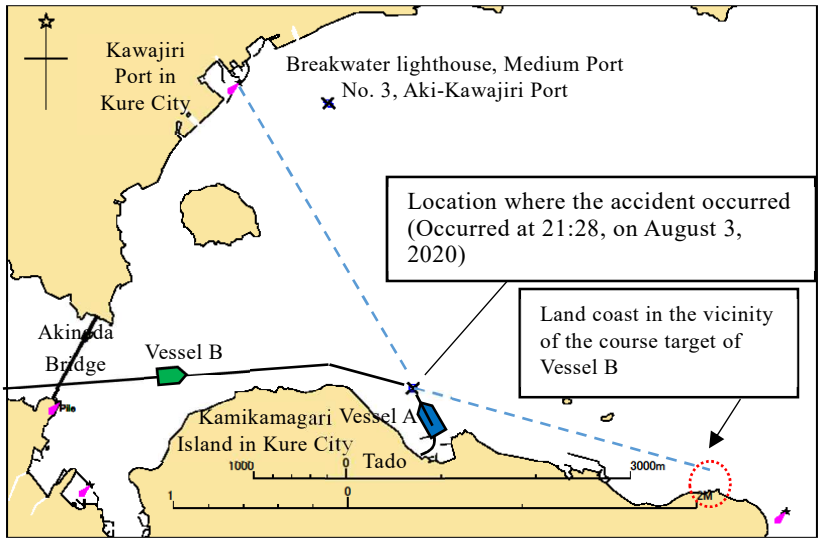
6. Small vessel accident investigation

Of the vessel accidents and serious incidents that the JTSB investigated, the number of accidents and serious incidents involving small vessels under 20 t reached 716 vessels in 2021, accounting for 66.3% of overall investigated cases in the ship field. Among them, many collision accidents have occurred, involving fishing vessels or pleasure boats with severe damage, such as the death of persons on board or heavily damaged hulls.

From such cases, one small vessel accident investigation report will be introduced.

[Summary]

On August 3, 2020, off the northern coast of Kamikamagari Island in Kure City, Hiroshima Prefecture, a pleasure boat (4.2 t) (Vessel A) was proceeding north northwest to return to the port after fishing, exhibiting a legal light, and a fishing vessel (1.0 t) (Vessel B) was proceeding east southeast to move to a fishing ground, exhibiting a bi-colored light. They collided, and a deckhand on the fishing vessel died due to wound shock.



Schematic diagram of accident occurrence progress

[Probable causes]

At night, the captain of the pleasure boat kept proceeding on the same course and at the same speed, focusing on setting the course to the breakwater lighthouse, Medium Port No. 3, Aki-Kawajiri Port. The captain of the fishing vessel was assuming that there was no vessel in the starboard direction and kept proceeding with the same course and at the same speed with a blind spot in the starboard bow direction. Therefore, it is probable that they collided without noticing that they were mutually approaching.

The investigation carried out the detailed interviews about the blind spot in the bow direction caused by the awning in place at the time of the accident and the objects that the crew members were focusing on, and the verifications of the captain's visual recognition of the radar screen from the maneuvering position, and so on. Further detailed interviews were conducted on the blind spot created by the net hauler in the fishing vessel's bow direction, the action conducted by the crew members in order to eliminate the blind spot, and so on.

As preventive measures against recurrence based on the investigation result, the Japan Transport Safety Board offered opinions as follows: (1) during navigation captains shall keep their eyes on the surroundings by the methods such as using a radar, without assuming that there are no other vessels around and without focusing on a specific direction only, (2) keep watching, covering any blind spots in the bow direction by standing up or moving horizontally and (3) persons who get on board small vessels shall always wear a life jacket on exposed decks.

7. Establishment of Small ship - Engine Trouble Search System (S-ETSS)

As mentioned in the preceding paragraph, the number of accidents and serious incidents involving small vessels under 20 t accounts for more than 60% of the overall accidents and serious incidents. In addition, many cases of crippled vessels involving failure in handling or maintaining engines, etc. occurred. From such cases, the Japan Transport Safety Board established and disclosed on its website the Small ship - Engine Trouble Search System (S-ETSS) for people involving in operations of small vessels in April 2021 (see Chapter 6, page 133).

S-ETSS shows cases of crippled small vessels involving faulty engines, collected from accident investigation reports published by the Japan Transport Safety Board, and also enables confirming the cases in a ranking format and in an easy-to-understand manner to find what failure occurs at which part.

Specifically, the top page of the S-ETSS enables confirming the number of failures for each engine part in decreasing order by selecting and searching an item of engine layout type (outboard or inboard motor, and so on.), fuel type, or faulty part (lubrication system, exhaust system, or electrical system, and so on.). For more information, the S-ETSS enables confirming not only the summary and causes but also the accident investigation report of each case.

The S-ETSS is available for anybody for free, excluding communication fees. Refer to the S-ETSS as a reference of the pre-departure inspection and regular inspections to ensure safety of maritime navigation.

Top page

Number of failures by engine part in a ranking format

List of accidents and probable causes

8. International technical cooperation in the railway field

The Japan Transport Safety Board has been addressing international technical cooperation through holding training sessions for overseas accident investigators and other actions, using the knowledge obtained through investigations of accidents and serious incidents. This section presents our two activities for supporting development of human resources in the railway field, progressed in 2021.

(1) India

In response to the request from Government of India, the Japan International Cooperation Agency (JICA) started the "Technical Cooperation (TC) project of Capacity Development on Railway Safety" in November 2018. The Japan Transport Safety Board has been actively participating in the project through visiting India to explain Japan's methods of investigating railway accidents, and so on, since the beginning of the project.

In July 2019, The JTSB held 10-day training sessions in Japan to provide 10 executives of the Ministry of Railways and the Commission of Railway Safety of India with technical knowhow of railway accident investigations, etc.

Since the spread of COVID-19, holding meetings in India has become difficult, so the method of meeting was changed from a face-to-face form to a web form to hold a plenary meeting in October

2020 and September 2021 in order to confirm the status of the project. At both meetings, the participants considered and suggested measures to improve issues based on the needs of and requests from India for the purpose of supporting the actions to embed technical knowhow there.

In addition to the confirmation of the achievements of the support, another meeting was held in December 2021 for the purpose of evaluating and providing advice on the railway accident investigation reports created by the accident investigation institution, etc. of India in order to facilitate further improvement. At this meeting, the Japan Transport Safety Board provided comments including concrete measures for improvements in detail on three reports, and received gratitude from India, saying that the comments were very good references for them.

(2) Singapore

The Transport Safety Investigation Bureau (TSIB) in Singapore has started investigations on accidents and serious incidents in the railway field since April 2020. The TSIB has implemented investigations on accidents and serious incidents in the aviation and marine fields, however the railway field is a new field for them to address, so the Japan Transport Safety Board received a request from the TSIB for support for development of human resources as railway accident investigators.

In response to the request, the JTSB held a meeting with the TSIB in a web form to explain Japan's railway accident investigation methods and past investigation examples, and also had a question-and-answer session, etc. mainly on basic matters. In the future, after implementing surveys on railway-related circumstances and training session needs in Singapore, the JTSB is to develop new training materials and provide more specialized training sessions, cooperating with external experts.

Column

Response to on-site interviews

Public Relations Office

Once an accident or serious incident to be investigated by the JTSB occur, the JTSB promptly dispatches accident investigators to the accident site to confirm the situation and collect information from related parties. In the case of an accident or serious incident of high social concern, news reports include our investigators working on-site, and also responding to informal interviews surrounded by reporters at times such as on-site investigation intervals.

It is necessary for accident investigators to bring information collected at the site to the JTSB, analyze it, and deliberate probable causes of and safety measures for the accident or serious incident in the JTSB. Therefore, investigators do not declare probable causes when interviewed at the site. However, especially in the case of an accident occurring at a place where general public cannot see, investigators try to explain the situation of the site to the extent possible at an informal interview surrounded by reporters.

Such informal interviews may be arranged by the Public Relations Office in advance to set up a place and timing that do not interfere with on-site investigations for informal interviews with cooperation of news correspondents in order to proceed with investigations effectively.

In addition, it is necessary to select a place where investigators and reporters do not disturb the general public and to obtain approval for the place. Moreover, in the case of investigations of airplane crash sites in mountains or vessels berthed on the sea, it is necessary for news correspondents to wait for investigators for long hours because it is unclear when they will come back to the place where news correspondents are waiting after finishing investigations for the day.

According to the location where an accident or serious incident occurs and the form of occurrence, responses to on-site interviews vary. The Japan Transport Safety Board considers the ability to provide smooth responses as much as possible through coordination between accident investigators and the Public Relations Office as an important thing to do in order to make our activities understood.

Example of responses to on-site interviews