－ Bridging Technology －

Improving the JTSB's accident investigation capabilities
- Development of research and analysis personnel and technology -

Research and Analysis Office

To ensure accurate accident investigations, as well as factual investigations such as obtaining feedback from the parties involved, work to inspect properties, collect materials and scientifically and objectively investigate data in line with information technology of various transportation systems is crucial and entails advanced and specialized data analytical technology.

As transportation systems have become increasing complex and diversified with advancing information technology, the Research and Analysis Office (hereinafter referred to as the "Analysis Office") of the JTSB has strengthened its analysis system by appointing the Director for Information Technology of the Accident Investigation, a newly established position in April 2024, to oversee the office and increasing the number of office staff from 10 to 15. Under this new organizational structure, the Analysis Office is engaged in daily operations with two themes: "advancing technological capabilities in accordance with the times" and "improving technological capabilities as an organization."

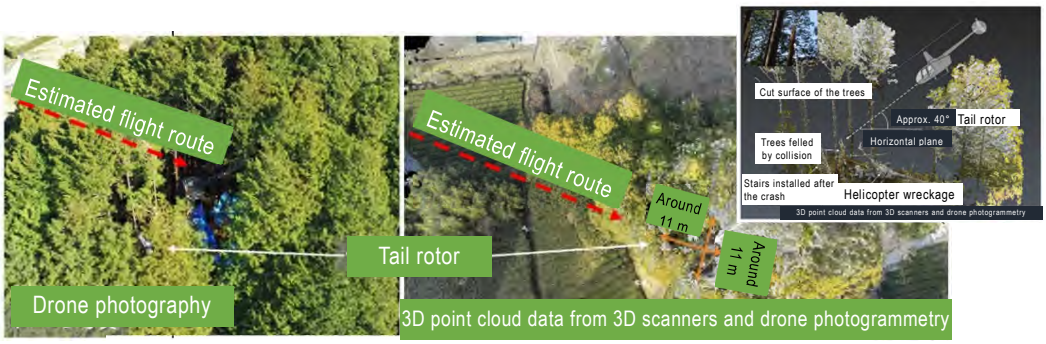
In recent years, demonstration experiments of flying cars, autonomous railways and Maritime Autonomous Surface Ships (MASS) have been progressing and data analysis will become increasingly important in future accident investigations, given that the operation of such next-generation transportation systems reduces the human factor involved. Accordingly, we are promoting efforts to acquire such analytical skills by participating in various IT analysis training programs held by other ministries and agencies and the private sector. We are also striving to improve our technical capabilities in IT analysis, such as investigating the latest trends in next-generation transportation systems that are expected to be practically applied in future.

At the same time, steadily passing on and refining the analytical technology cultivated by the JTSB remains important. With this in mind, we are also actively engaged in HR development to improve our technical capabilities, including training in aircraft digital data via external experts on flight data recorders, instruction in high-level analytical techniques from skilled to newly appointed personnel through OJT and developing and maintaining various manuals.

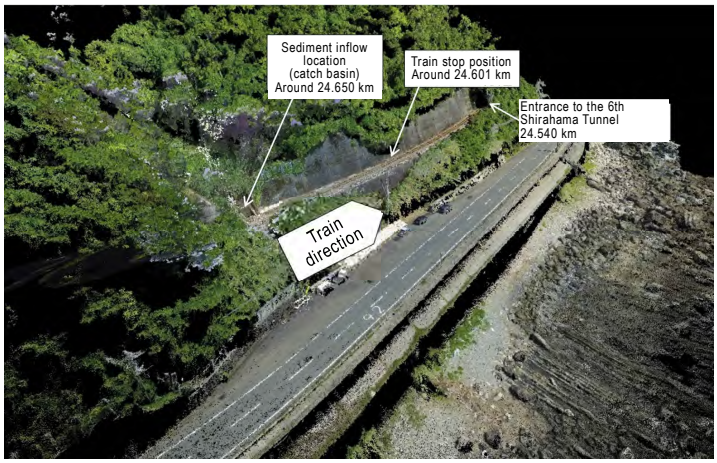
Staff of Research and Analysis Office (JTSB Lab)

The JTSB also actively utilizes various investigative tools in a timely manner to improve its investigative capabilities. For example, this includes promoting the use of aerial photography via small UA (drones) and 3D scanners. Given the effectiveness of using 3D models created using these two instruments alone or in combination to understand the circumstances at accident sites, we are actually using them in aircraft, railway and marine accident investigations (see figure below). Drones in particular require appropriate knowledge and skills to operate, as well as photographing, surveying and flexible use in actual investigations. Accordingly, we systematically train our staff to operate such drones and carry out surveys on an ongoing basis, even after they obtain national qualification as small UA operators, so that we can investigate accidents via drone as rapidly and accurately as possible.

Utilization of 3D scanners and drones in accident investigations



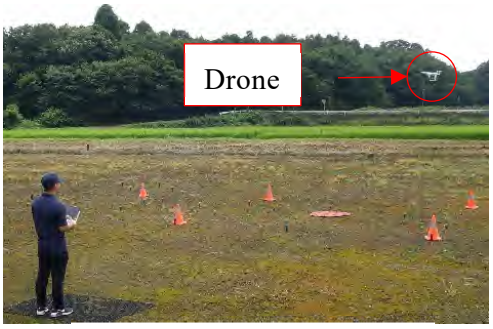
Example of utilization in aircraft accident investigations



Example of utilization in railway accident investigations

3D Scanners

Drone



Drone operator training

Moreover, this year, leveraging information obtained from overseas investigative organizations at international accident investigation conferences, we introduced the latest analytical software for ships, which is being used by many accident investigation organizations and becoming a global standard. This enables integrated analysis of multiple data such as Voyage Data Recorders (VDRs), Automatic Identification Systems (AIS), GPS and voice on the bridge of multiple ships and allows us to reproduce the circumstances of marine accidents in 3D simulations. We will work to improve our data analysis

Navigation data analysis device operation

capabilities in marine accidents, which will include sharing analytical techniques with overseas investigative organizations that have also introduced these.

Given the rapid evolution of digital technology and the development of next-generation transportation systems in recent years, it is even more important to improve and enhance our technological capabilities accordingly to respond reliably to accident investigations. The JTSB will systematically promote research and studies on information technology across aircraft, railway and marine fields, and strive to improve our accident investigation capabilities.

Improving the Technical Skills of Marine Accident Investigators

Marine Accident Investigator

Marine accident investigators must respond to wide-ranging accidents and incidents (symptom of accident) (hereinafter referred to as "accidents and incidents") involving various types of vessels, from small vessels such as fishing vessels and pleasure boats to large vessels such as cargo ships and tankers, including collisions, grounding, foundering, fires and loss of control due to engine or steering malfunctions.

Therefore, marine accident investigators are appointed from individuals with specialized knowledge in the maritime accident. However, accident investigations are required knowledge of all aspects of ship operations, including navigation and engine operation, as well as a broad range of expertise utilizing in-depth investigations and various analytical techniques to determine the cause of the accident. As a result, marine accident investigators strive to acquire knowledge and improve their abilities through daily accident investigations and utilize practical training opportunities to enhance their expertise and technical skills in accident investigations.

Additionally, with the advancement of marine technology, new technologies and systems are being introduced and marine accident investigators strive to acquire new knowledge and skills by attending various training courses alongside accident investigations, with each investigator working daily to improve their knowledge and skills.

This time, we will introduce the "Operational Practice Training" among the trainings, conducted in September 2024.

This training was organized by the Japan agency of Maritime Education and Training for Seafarers (JMETS), which is an independent administrative institution and was attended by newly appointed marine accident investigators, as well as participants from the Japan Marine Accident Tribunal and the Maritime Bureau. The agency plays a central role in seafarer education in Japan, accepting students from seafarer education institutions such as mercantile marine universities and technical colleges and training new seafarers through navigation training on training ships in conjunction with classroom lectures.

This training was conducted using the JMETS's training ship, "Taisei maru," and was a practical training where participants received explanations from crew members about the equipment installed on the ship and its handling.

The content of this training aimed to increase knowledge related to ship operation, and participants learned the following:

◯ Handling navigational instruments (Radar/ARPA*[1]ECDIS*[2])

・Types and usage of navigational instruments such as radar and ECDIS installed on the bridge to assist with lookout, and information displayed, including how to confirm ships' location and the closest point of approach.

◯ On-duty experience through a ship simulator

・Experiences such as general ship-handling decisions and dangerous navigation situations:

various navigation conditions and sea area settings, settings for surrounding vessels such as head-on and crossing situations, etc. were available.

◯ Handling of emergency locator transmitters / Responding to distress communications

・Methods of sending and receiving distress signals via radio (satellite to land-based station to ship) such as EPIRB*3 etc., visual display on radar SART*4, two-way radiotelephone apparatus, and distress communications via medium- and short-wave radios, etc.

◯ VDR*5 Data Extraction Training (Classroom Only)

・VDR information (navigation information, radar images, audio, etc.), storage time, data storage location, etc.

Bridge of the training ship "Taisei Maru"
(Lower left: ECDIS, Upper right: Radar/ARPA)

Ship Simulator installed on the training ship bridge on the lower deck

The experience of performing watchkeeping duties using a ship simulator, extracting objective data, and handling navigational instruments and life-saving appliance were all crucial for future accident investigations and other purposes.

Additionally, speaking directly with crew members responsible for training the seafarers provided a valuable opportunity to learn about the practical aspects of ship operations, as well as the mindset and actions taken in those situations.

The on-board training is also intended to cultivate the qualities necessary for being a seafarer and impacts significantly on the safety awareness of the seafarers who graduate from the JMETS. We believe that it is important to understand the training and methods for acquiring such seafarer qualities and safety awareness when investigating accidents and incidents.

In addition to the training mentioned above, marine accident investigators undergo various training programs every year, ranging from basic training on all aspects of ships to specialized training on investigation and analysis, including classroom lectures on marine engineering and marine meteorology, training by equipment manufacturers on how to extract data from VDRs and GPS plotters, training by engine manufacturers on investigating the cause of fire accidents at the site and engine structure and

systems, as well as training to incorporate new knowledge and skills as marine technology advances.

*1: Automatic Radar Plotting Aids (ARPA) - A device that processes information received from a radar, captures and tracks objects such as other ships, predicts their movements, and alerts the crew of potential dangers.

*2: Electronic Chart Display and Information System (ECDIS) - A device that displays an Electronic Navigational Chart (ENC) on a monitor screen, can display information such as the ship's position and planned route overlaid, and has an alarm function to alert the crew of approaching shallow waters, etc.

*3: Emergency Position Indicating Radio Beacon (EPIRB) - A buoy-type device that transmits distress signals to satellites orbiting the Earth.

*4: Search And Rescue Radar Transponder (SART) - A device that automatically transmits response radio waves when it detects radar waves emitted by patrol vessels or aircraft while searching, and alerts the locations of the persons in distress.

*5: Voyage Data Recorder (VDR) - A device that can record data related to navigation, such as the ship's position, course, speed and radar information, as well as communications from international VHF radiotelephone equipment and voice in the bridge.