information such as the positions and altitudes of aircraft in flight and cockpit audio and image (hereinafter referred to as "FDM", See Figure 1) has been developed recently, although it is small, light, and low price. FDM is expected to be utilized not only for accident investigations but also for the reduction in safety risks by operators.

The utilization of FDM by other countries as a safety measure has been discussed at the "Small Aircraft Safety Promotion Committee" held regularly by the Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism. As a result of conducting substantive investigations (collection and analysis of operational data and evaluation of equipment) for several years, FDM was found to contribute to the improvement of safety of small aeroplanes. Therefore, it was decided to facilitate its introduction.

The Digests present how information obtained from FDM contributes to safe operations of aircraft in terms of the improvement of skills of pilots including training and risk management by extracting near-miss incidents in daily operations. Moreover, the importance of objective information is explained by introducing what type of information is collected and how it is utilized when JTSB creates investigation reports based on accident investigation reports published in the past. Also, how enhancement of objective information can contribute to preventing accidents from recurring by installing FDM on many aircraft will be explained.

2. Data of recent aircraft accidents

1. Data of aircraft accidents

This figure shows the details of 162 accidents occurred in the past 10 years by year. The number of accidents involving small aircraft varies between 4~20 (See Figure 2).

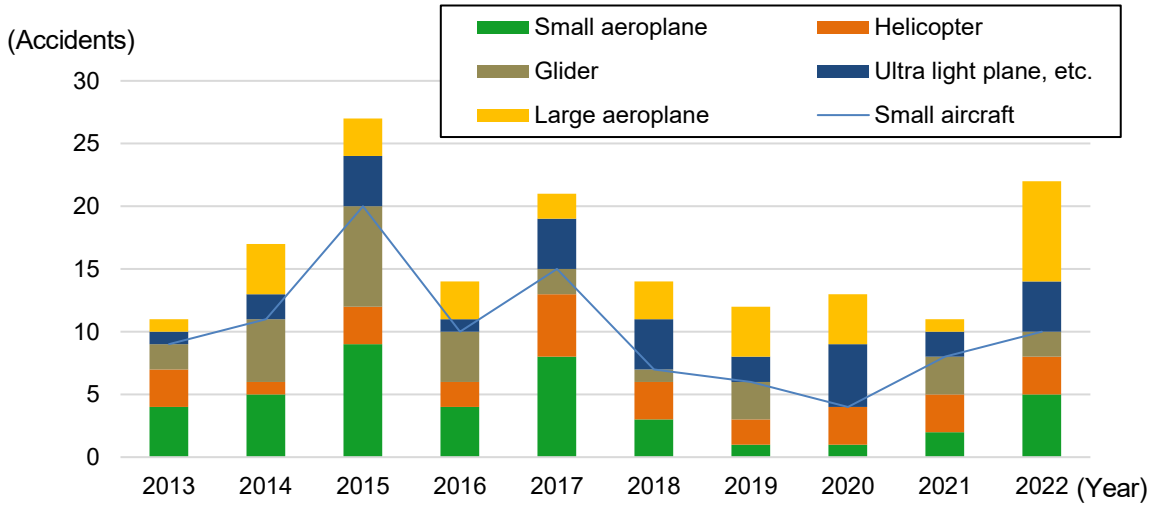

Figure 2: Number of aircraft accidents by year (2013~2022)

The following figure shows the number of accidents in the past 10 years by type of aircraft. The number of accidents of small aircraft is 100 and accounts for approximately 60% of the total number of accidents (Figure 3).

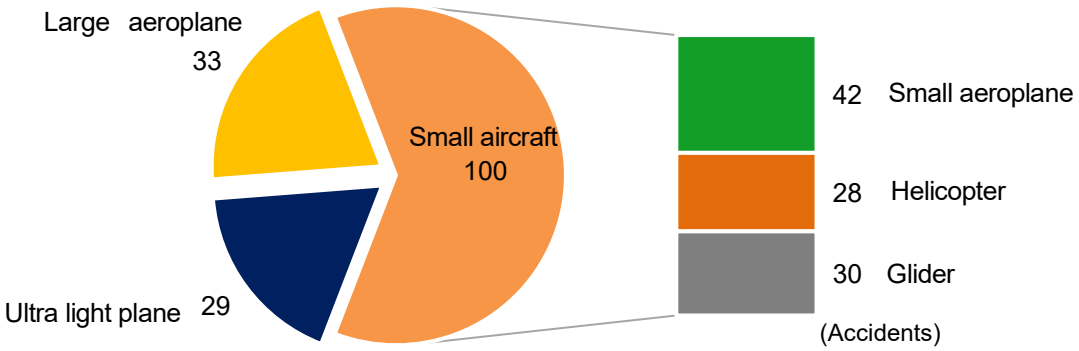

Figure 3: Number of aircraft accidents by type of aircraft (2013~2022)

2. Data of fatal accidents

The number of fatal accidents in the past 10 years is 31, while the number of fatalities is 70 persons. No fatal accident involving large aeroplanes has occurred, while 24 out of 31 accidents (77%) were caused by small aircraft. The number of fatalities caused by accidents involving small aircraft is 61 out of 70 (87%). Helicopters claimed many casualties (30 persons (43%) died in 9 accidents (29%)). Two accidents involved in large helicopters for disaster prevention activities in which 9 persons on board died. Furthermore, 7 accidents (about 23%) involving small aircraft claimed 19 lives (27%), while 8 accidents (26%) involving gliders claimed 12 lives (17%) (See Figure 4).

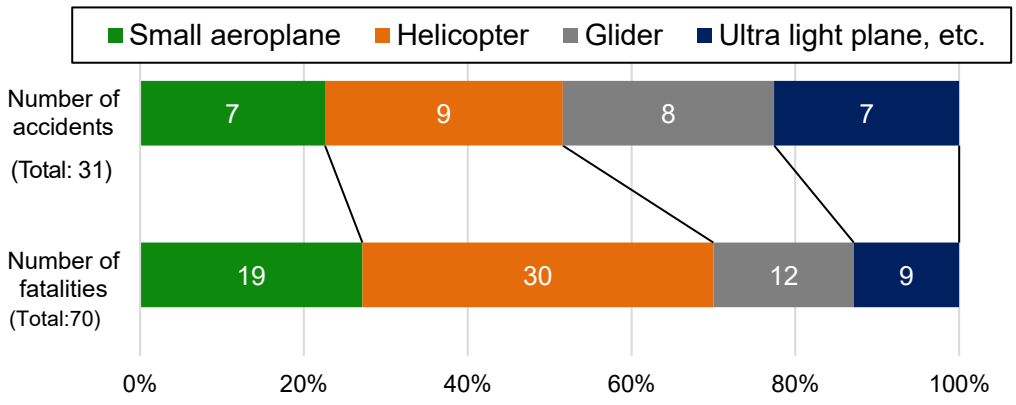

Figure 4: Number of fatal accidents and fatalities by type of aircraft

These data indicate that reducing in the number of accidents involving small aircraft is directly linked to the reduction in victims. Therefore, preventive measures are very important.

3. Data of accidents by cause

The following graph categorizes the causes of accidents in accident investigation reports of small aircraft, published in the past 10 years (January 2013 ~ December 2022). The most common cause is "human factors" which include operations of pilots, etc., accounting for 37 out of 95 accidents (39%). Then, 25 accidents (26%) were caused by human factor and environmental factor (meteorological conditions, etc.). These two causes account for 65% of the total number of accidents. Furthermore, human factors involve in over 80% of accidents (a total of 83 accidents), if "human factor + mechanical factor (equipment failure, etc.)" and human factor + organizational factor (safety management system, etc.)" are included (See Figure 5).

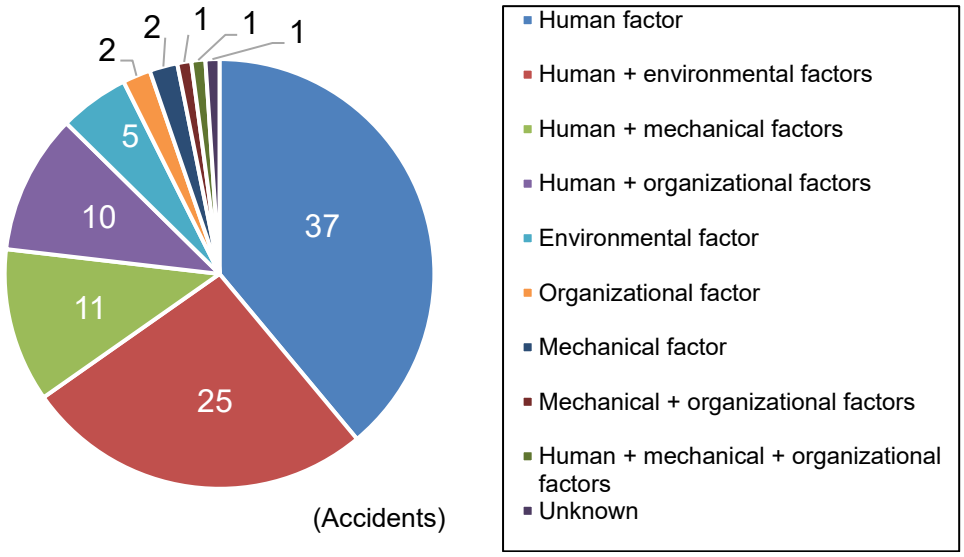

Figure 5: Number of accidents by cause

As far as this figure shows, we can see that human factors involve in many accidents. Moreover, when we analyze accidents caused by human factors in more detail, there are cases that could have been avoided by appropriate risk management such as "an aircraft in flight by visual flight rules entered into flight in the clouds", "an aircraft crashed into trees or transmission lines due to the lack of visibility", "an aircraft was not controlled appropriately due to the lack of necessary knowledge or skill", or "necessary safety check was omitted".

To prevent accidents involving small aircraft that show the above-mentioned tendencies, it is certainly important to ascertain the causes of accidents and the factors of damages from investigation reports published by JTSB and other sources to prevent similar accidents from recurring. It is also important to identify any indication of accident in daily operations such as near-miss incidents and deviation from standard procedures which is not perceived by oneself, carry out risk management based on such information, and take preventive measures for improving safety. A method of risk management to prevent accidents by collecting as many unsafe events (factors) as possible and taking their preventive measures is adopted not only in aircraft operations but also in a wide range of areas.

First of all, it is important to accurately identify the state of an aircraft when an unsafe event occurs based on objective flight data and investigate the cause in order to translate risks collected by the above methods into the prevention of accidents. Once what happened is found out by analyzing objective flight data obtained, it becomes feasible to take more effective preventive measures and initiatives.

In the next chapter, we introduce flight data monitoring device (FDM) equipped with the functions of collecting flight operational data necessary for reducing safety risks through preventive measures and of utilizing such data for training programs for pilots and the preservation of their skills.

3. What is flight data monitoring device?

Flight data monitoring devices (FDM) are a collective term of devices capable of recording information such as the positions and altitudes of aircraft in flight, cockpit audio and image, etc. for the purpose of flight data monitoring*1. In the Digests, FDM refers to all devices installed on aircraft the aim of recording flight conditions other than flight recorders (See Figure 6) mandated to be installed under the provisions of the Civil Aeronautics Act. Since flight recorders are installed for the purpose of conducting accident investigations, high resistance to impact, fire, and water pressure is required. It is not that straightforward for an operator to use a recorded data for analysis of flight conditions. On the other hand, FDM is less resistant to impact than flight recorders, but operators can use objective information (data) recorded for various purposes (See Table 1 for recordable data).

Large aeroplanes such as airliners are equipped with quick access recorders (QAR) capable of recording broader data than FDR so that operators can collect available data in the same way as FDM. Operators monitor the status of operations of aircraft on a regular basis using data sent from QAR and utilize it for risk management and safe operations.

Figure 6: Flight recorders (Left: FDR, Right: CVR)