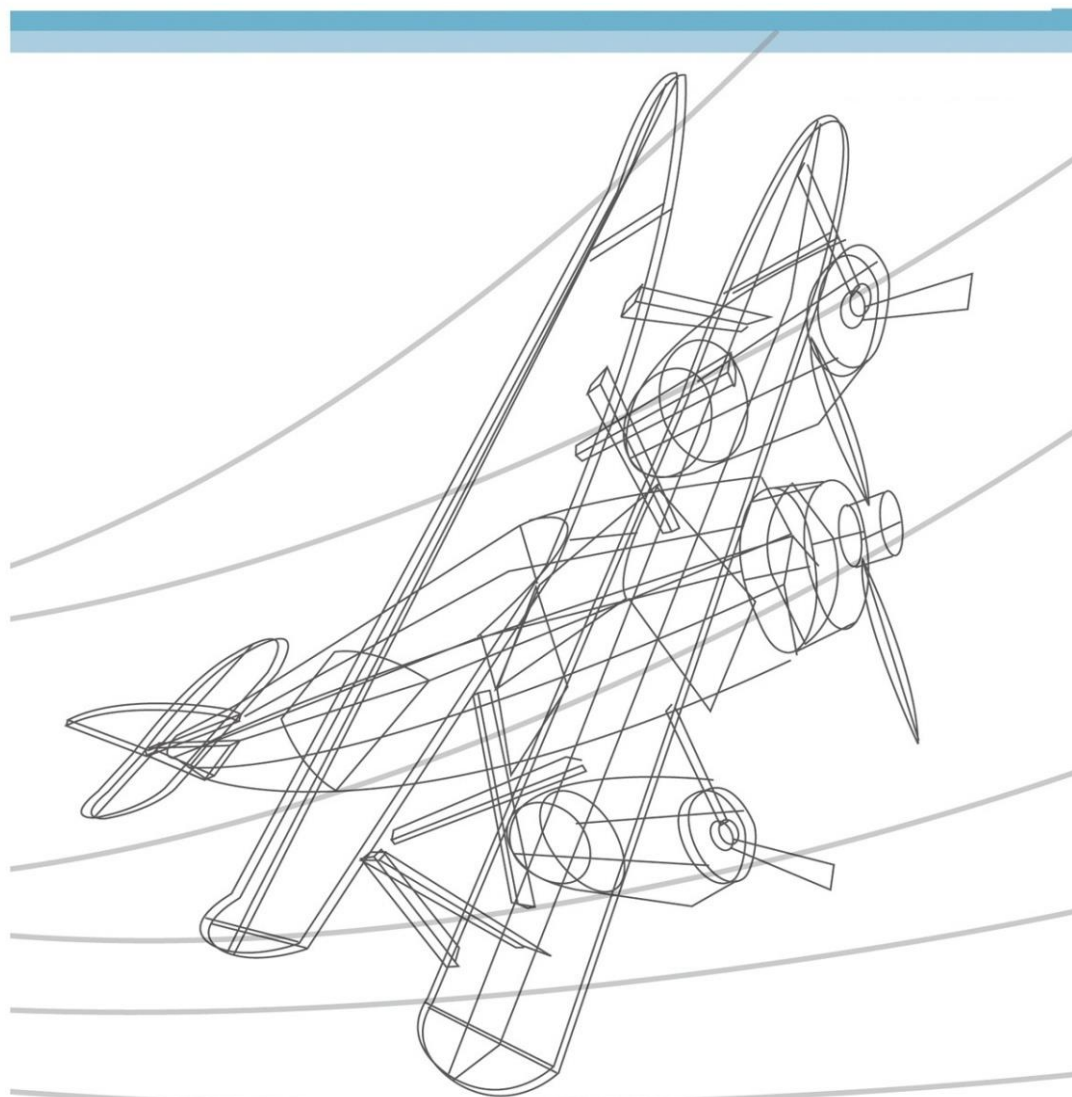


# Taiwan Aviation Occurrence Statistics 2012–2021



國家運輸安全調查委員會  
Taiwan Transportation Safety Board

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## **Abstract**

### **2021 Aviation Occurrence Statistics**

In 2021, Taiwan's national aircraft were involved in four major aviation occurrences, one of which involved a civil air transport aircraft. That occurrence did not result in any fatalities but caused substantial damage to the aircraft and thus met the International Civil Aviation Organization's (ICAO) criteria for an accident. Both the fatal occurrence rate and the hull loss rate for civil air transport aircraft for 2021 were 0; however, the accident rate was 6.8 accidents per million departures. Two occurrences involved ultralight vehicles, one resulting in hull loss and the other resulting in light damage; in addition, each of these occurrences resulted in two fatalities and severe injuries to one person. One occurrence involved drones and resulted in hull loss. No major aviation occurrences involving general aviation carriers, national helicopters, or public aircraft were reported in 2021.

### **Occurrence Statistics 2012 to 2021**

From 2012 to 2021, national aircraft were involved in 81 major aviation occurrences; civil air transport operations accounted for 46 of these occurrences, and the remainings were 10 general aviation aircraft occurrences, 2 flight trainer occurrences, 1 free balloon occurrence, 12 ultralight vehicle occurrences, 7 public aircraft occurrences, and 3 drone occurrences. These occurrences resulted in 118 fatalities.

Civil air transport turbojet airplanes in Taiwan have experienced no hull losses or fatalities over the preceding 10 years. Therefore, the 5-year moving averages for the hull loss rate and fatal occurrence rate both remained at 0 and were thus lower than the 2017–2021 global turbojet hull loss and fatal accident rates (which were 0.16 and 0.10, respectively) reported by International Air Transport Association (IATA).

Owing to one occurrence involving a civil air transport turboprop airplane resulting in hull loss and fatalities each in 2014 and 2015 (TransAsia Airways flights GE222 and GE235, respectively), the 5-year moving average of the hull loss rate for turboprop airplanes increased to 3.15 occurrences per million departures in 2014 and then to 6.22 occurrences per million departures in 2015. However, since 2019, the 2014 GE222 crash has not been included in the moving average, and thus the 5-year moving average for the 2015–2019 hull loss rate dropped to 3.02; the same is true for the fatal occurrence rate. Furthermore, since 2020, the 2015 GE235 crash has not been included in the moving average, and thus the 5-year moving average for 2016–2020 for both the total hull loss and fatal occurrence rates dropped to 0. Owing to the absence of hull loss

or fatal occurrences in 2021, the 5-year moving average for the 2017–2021 total hull loss and fatal occurrence rates remained at 0. In global, the IATA 5-year moving average global turboprop hull loss and fatal occurrence rates exhibited downward trends; the 2017–2021 average hull loss rate was 1.02 occurrences per million departures, and the fatal occurrence rate for the same period was 0.77 occurrences per million departures.

Of the 46 major aviation occurrences involving national civil air transport aircraft in the preceding decade, 10 met the ICAO’s definition of an accident. Among these 10 accidents, five involved turbojets and collectively resulted in severe injuries to 4 people; the other five involved turboprops and included two accidents resulting in hull loss, 91 fatalities, and 24 people with severe injuries. In addition, according to the ICAO flight phase taxonomy, 20 of these 46 major aviation occurrences took place in the enroute phase, followed by 19 in the landing phase. Furthermore, according to the ICAO occurrence categories, 13 of these occurrences were runway excursions, followed by 12 that involved system/component failures or malfunctions (nonpowerplant). Furthermore, according to the classification of occurrence causes by the U.S. National Transportation Safety Board, most of these occurrences had “human-related” causes (67.4%), followed by those with “environment-related” causes (41.3%) and then those with “aircraft-related” causes (37%).

For national general aviation operations, four hull loss occurrences took place in the 10-year period; all four resulted in fatalities. The 5-year moving average for the hull loss and fatal occurrence rates exhibited a rising trend prior to 2017, with a peak of 2.58 occurrences per 10,000 flights. From 2018, the moving average began to fall and dropped to as low as 0.53 occurrences per 10,000 flights in 2021.

National helicopters<sup>1</sup> were involved in three hull loss occurrences in the 10-year period in question, all of which resulted in fatalities. Prior to 2017, the 5-year moving average for the hull loss and fatal occurrence rates rose yearly and reached a peak of 3.49 occurrences per 10,000 flight hours, or 4.30 occurrences per 10,000 departures. No helicopter has been involved in an aviation occurrence since 2017, and the 5-year moving average began declining in 2018 and reached as low as 1.23 occurrences per 10,000 flight hours, or 1.56 occurrences per 10,000 departures in 2016–2020. In 2021, the 5-year moving average rose to 1.55 occurrences per 10,000 flight hours, or 1.91 occurrences per 10,000 departures.

National public aircraft were involved in three hull loss occurrences and four fatal occurrences in the 10-year period. The 5-year moving average for the hull loss and fatal occurrence rates began rising gradually in 2018. The hull loss rate peaked at 0.93

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<sup>1</sup> These figures do not include public helicopters.

occurrences per 10,000 flight hours, or 1.32 occurrences per 10,000 departures, in 2020 and then dropped to 0.60 occurrences per 10,000 flight hours, or 0.87 occurrences per 10,000 departures in 2021. The fatal occurrence rate increased markedly in 2018 and peaked at 1.24 occurrences per 10,000 flight hours, or 1.76 occurrences per 10,000 departures in 2020. That rate then fell to 0.91 occurrences per 10,000 flight hours, or 1.30 occurrences per 10,000 departures in 2021.

National ultralight vehicles were involved in 12 major aviation occurrences in the 10-year period. Of these occurrences, 11 led to hull loss, and four were fatal, resulting in six deaths in total.

National drones were incorporated into the investigative scope of the Taiwan Transportation Safety Board (TTSB) in April 2019. As of the end of 2021, three major aviation occurrences involving drones have taken place; two of these drones experienced total hull loss, and one was declared missing. However, none of these occurrences led to fatalities.

### **Safety Recommendation Statistics**

From the establishment of the Aviation Safety Council (the organization before restructuring to the TTSB) in 1998 to the end of 2021, we published 135 major aviation occurrence reports and proposed 1,087 recommendations to improve transportation safety. The greatest proportion of the recommendations was targeted at government-affiliated agencies (52.9%), followed by aviation operators (36.2%) and then international institutions (11.2%). Of the 575 recommendations aimed at government-affiliated agencies, 97.6% (561 cases) have now been implemented, and the remaining 2.6% (14 cases) are still being overseen by the Executive Yuan.



## Introduction

The first section of this report summarizes the operations of national aircraft in 2021 and over the preceding 10 years (2012–2021). The topics covered include domestic airlines and their numbers of aircraft, civil air transport carriers, general aviation carriers, ultralight vehicles, drones, flight training organizations, free balloons, and public aircraft in Taiwan.

The second section, which is the focus of this year’s aviation safety statistics report, offers a general overview of the statistics and analyses of aviation occurrences. The section begins with a basic introduction of the data sources, definitions, and classifications adopted in this report. The main content includes a summary of major aviation occurrences involving national aircraft in the preceding decade, as well as statistics related to major aviation occurrences involving national civil air transport carriers, national general aviation carriers, national helicopters, Taiwan’s public aircraft, ultralight vehicles, and drones.

The third section tracks the progress of transportation safety recommendations and action plans and covers the categorization of historical improvement suggestions, their corresponding statistics, the tracking of improvement suggestions and action plans, and the status of action plans deemed “under supervision.”

This report was compiled using civil aviation jargon and statistical terms that are commonly used by international organizations; relevant definitions and descriptions are provided in the appended glossary.

## I. Operational Overview of National Aircraft<sup>2</sup>

### 1.1 Domestic Airlines and Numbers of Aircraft

Eight civil air transport carriers were in operation in Taiwan in 2012. Since then, multiple domestic airlines have entered and exited the market. These activities include the establishment of V Air and Tigerair Taiwan in 2014 and the deregistration of SunRise Airlines and V Air as civil air transport carriers in 2015 and 2017, respectively. In 2018, TransAsia Airlines declared bankruptcy, and Emerald Pacific Airlines was registered as a civil air transport carrier. Starlux Airlines was established in 2019. The Ministry of Transportation and Communications revoked the air operator certificate of Far Eastern Air Transport in 2020. At the end of 2021, eight national civil air transport carriers<sup>3</sup> were in operation, two of which<sup>4</sup> provided helicopter transportation services.

Taiwan's general aviation companies increased in number from 9 in 2012 to 13 in 2021.<sup>5</sup> Market changes during the intervening years included the launch of SkyRainbow Airlines and EVA Air's acquisition of a general aviation operating permit in 2014, the deregistration of SunRise Airlines's general aviation license for civil aviation in 2017, the registration of TDA Air in 2019, the launch of Sky Vision in 2020, and the deregistration of TDA Air's general airlines license and the registration of Strong Aviation and RealWorld Aviation in 2021.

Three airlines<sup>6</sup> in Taiwan operate both civil air transport services and general aviation services; therefore, Taiwan has 18 airlines in total. The fluctuating number of national airlines from 2012 to 2021 in Taiwan is depicted in Figure 1; the operational overview indices over the preceding 10 years are presented in Appendix 1.

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<sup>2</sup> The statistics presented in this section mainly reference the Ministry of Transportation and Communications's annual transportation reports, the Civil Aeronautics Administration's annual reports on civil air transportation statistics, and data provided by the National Airborne Service Corps.

<sup>3</sup> These carriers were China Airlines, EVA Air, Mandarin Airlines, Uni Air, Tigerair Taiwan, Starlux Airlines, Emerald Pacific Airlines, and Daily Air.

<sup>4</sup> In addition to operating scheduled and nonscheduled transport services on domestic offshore and outlying air routes, Daily Air operate scheduled and nonscheduled helicopter transport services on domestic routes. Emerald Pacific Airlines also operates helicopter transport services on domestic routes.

<sup>5</sup> These companies were Daily Air, RoC Aviation Services, Emerald Pacific Airlines, Great Wing Airlines, Aerospace Industrial Development Corporation, Win Air, Executive Aviation, Avanti Aviation, EVA Air, SkyRainbow Airlines, Sky Vision, Strong Aviation, and RealWorld Aviation.

<sup>6</sup> These three airlines are Daily Air, Emerald Pacific Airlines, and EVA Air.

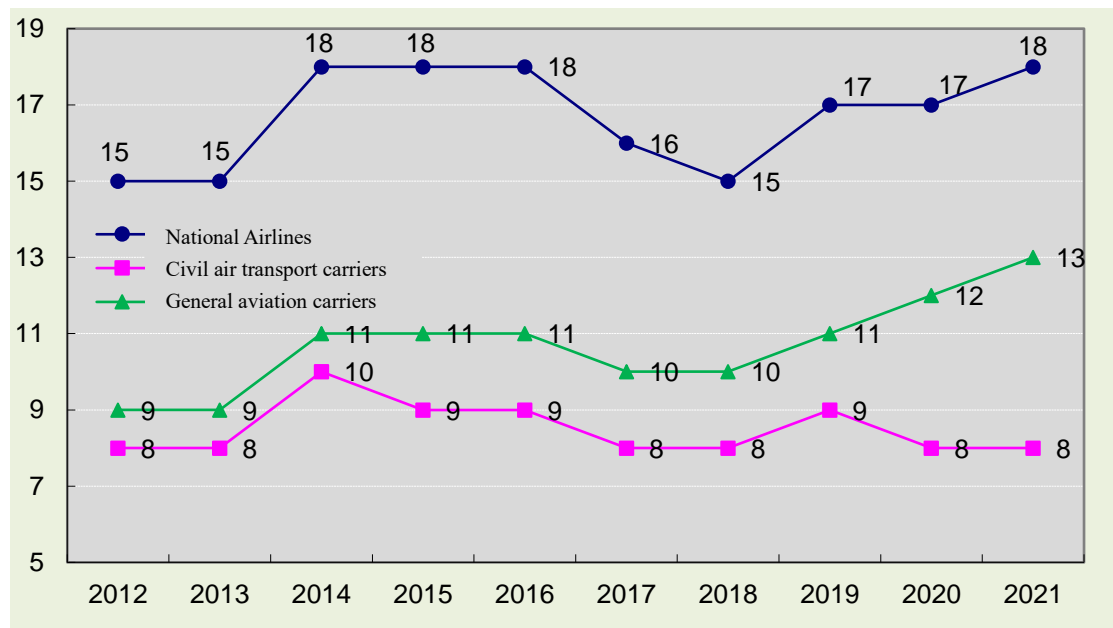


Figure 1 Civil air transport and general aviation carriers

Over the preceding 10 years, the number of aircraft registered in Taiwan<sup>7</sup> has increased steadily mainly because of airlines expanding their fleets and the continual introduction of hot air balloons in Taiwan. For example, the number of aircraft registered in Taiwan increased from 210 in 2012 to a peak of 278 in 2019. Subsequently, the closure of Far Eastern Air Transport in 2020 lowered the number of airworthy aircraft. The number of airworthy aircraft is depicted in Figure 2. At the end 2021, Taiwan had 270 airworthy aircraft and 293 registered aircraft.

<sup>7</sup> This number covers only aircraft owned by civil air transport and general aviation carriers and does not include public aircraft, ultralight vehicles, or drones.

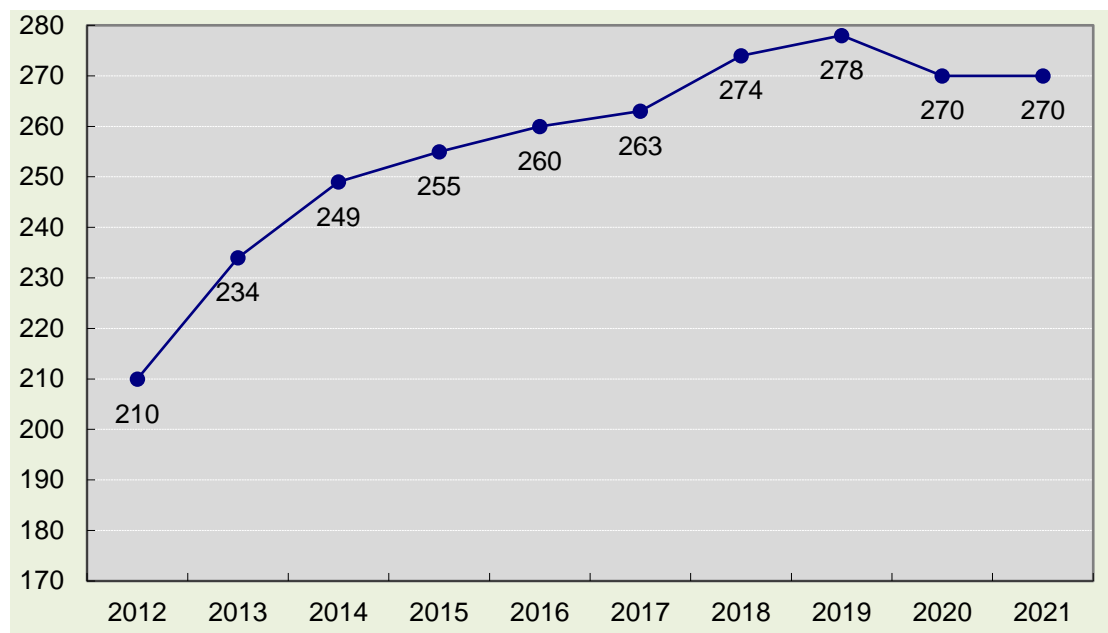


Figure 2 Number of airworthy aircraft in airline fleets

## 1.2 Civil Air Transport Carriers

### Passenger Transportation

In 2021, owing to the impact of the COVID-19 pandemic, civil air transport airlines in Taiwan carried approximately 3.79 million passengers, a 62.9% decrease from 2020. In addition, approximately 5.2 million passengers traveled on international and cross-strait routes, accounting for 13.7% of all passengers in 2021, a 90% decrease from 2019. Finally, 3.27 million passengers traveled on domestic routes in 2021, accounting for 86.3% of all passengers, a 35.1% decrease from 2020.

Figure 3 presents trends related to civil air transport passengers in Taiwan from 2012 to 2021. During that period, the overall number of passengers increased from approximately 27.87 million in 2012 to a peak of approximately 38.52 million in 2019 before then declining markedly to 10.22 million in 2020 as a result of the COVID-19 pandemic. This number then further dropped to 3.79 million passengers in 2021. In the same period, passengers taking international and cross-strait routes increased in number yearly from approximately 22.55 million in 2012 to a peak of 32.41 million in 2019. This number also declined markedly, to 5.19 million, in 2020 and then further still, to just 520,000, in 2021. Finally, approximately 5.32 million passengers traveled on domestic routes in 2011; after a slight decline and recovery in 2015, this number rose to a peak of 6.11 million in 2019 before dropping to 5.03 million in 2020 and further to 3.27 million in 2021.

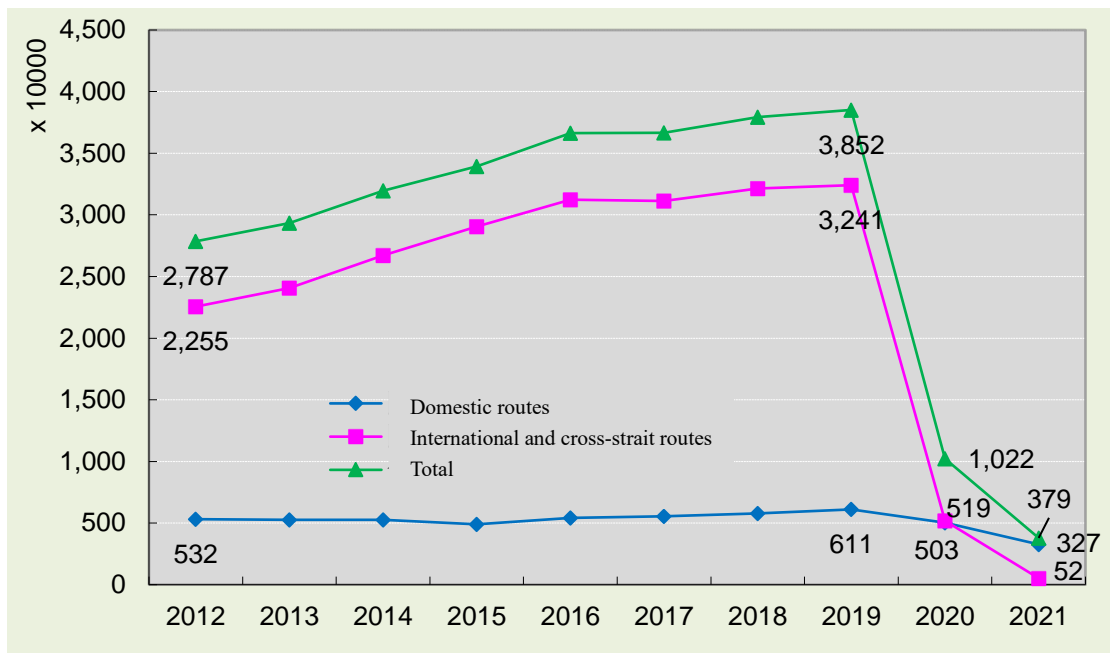


Figure 3 Civil air transport passenger numbers

### Freight

In 2021, civil air transport carriers in Taiwan transported approximately 2.68 million tons of air cargo, a 16.2% increase from the previous year. Furthermore, approximately 2.647 million tons of air cargo was transported on international and cross-strait routes, far surpassing the amount of air cargo on domestic routes and accounting for 98.8% of all transported air cargo, an 16.9% increase from the previous year. By contrast, only approximately 33,000 tons of air cargo were carried on domestic routes, accounting for 1.2% of all air cargo and resulting in a 20.8% decrease from 2020.

Figure 4 presents trends in air freight carried by national civil air transport companies from 2012 to 2021. The overall cargo load increased from approximately 1.659 million tons in 2012 to a peak of approximately 2.68 million tons in 2021, with a notably considerable increase in 2017; the 10-year growth rate was 61.4%. International and cross-strait routes transported approximately 1.611 million tons of cargo in 2012. After substantial growth in 2017, an all-time high of 2.647 million tons of air freight was transported in 2021; the 10-year growth rate was 64.3%. After transporting approximately 49,000 tons of cargo in 2012, domestic routes exhibited a 32.7% decline in total cargo tonnage over the 10-year period in question.

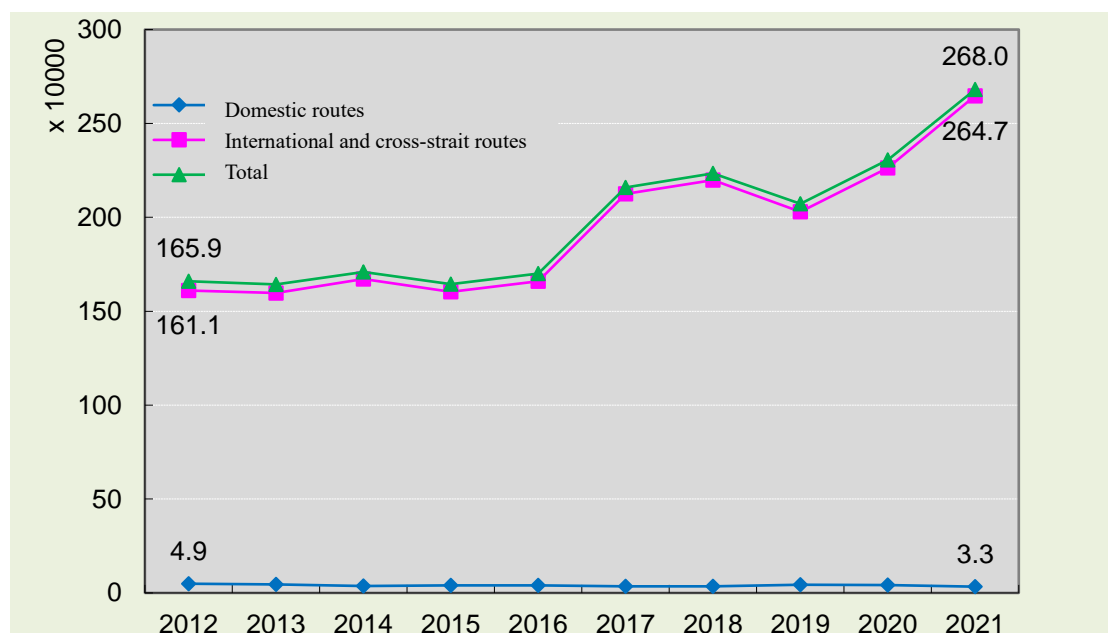


Figure 4 Air freight carried by national civil air transport carriers

### Number of Flights

Owing to the COVID-19 pandemic, civil air transport carriers in Taiwan operated only approximately 132,900 flights in 2021, a 19.8% decrease from 2020. Approximately 77,500 of these flights were international and cross-strait routes, which accounted for 58.3% of all flights, a 10% decrease from 2020. Approximately 55,400 flights were operated on domestic routes, accounting for 41.7% of all flights, a 30.4% decrease from 2020.

Next, Figure 5 depicts trends of flights operated by civil air transport carriers from 2012 to 2021. The total number of flights increased steadily from approximately 217,800 flights in 2012 to a peak of 273,600 flights in 2019, with a slight drop in 2017, before a massive drop to approximately 165,800 flights in 2020 as a result of the global pandemic. The number then dropped further to 132,900 flights in 2021. The number of flights on international and cross-strait routes increased from 132,900 in 2012 to a peak of 178,800 flights in 2016 and then dropped to 86,100 flights in 2020. This number then further dropped to 77,500 flights in 2021. The number of flights operated on domestic routes was approximately 84,900 in 2012 and demonstrated an overall moderate upward trend, peaking at 98,900 in 2019; this number then dropped to 79,700 in 2020 and further to 55,400 flights in 2021.

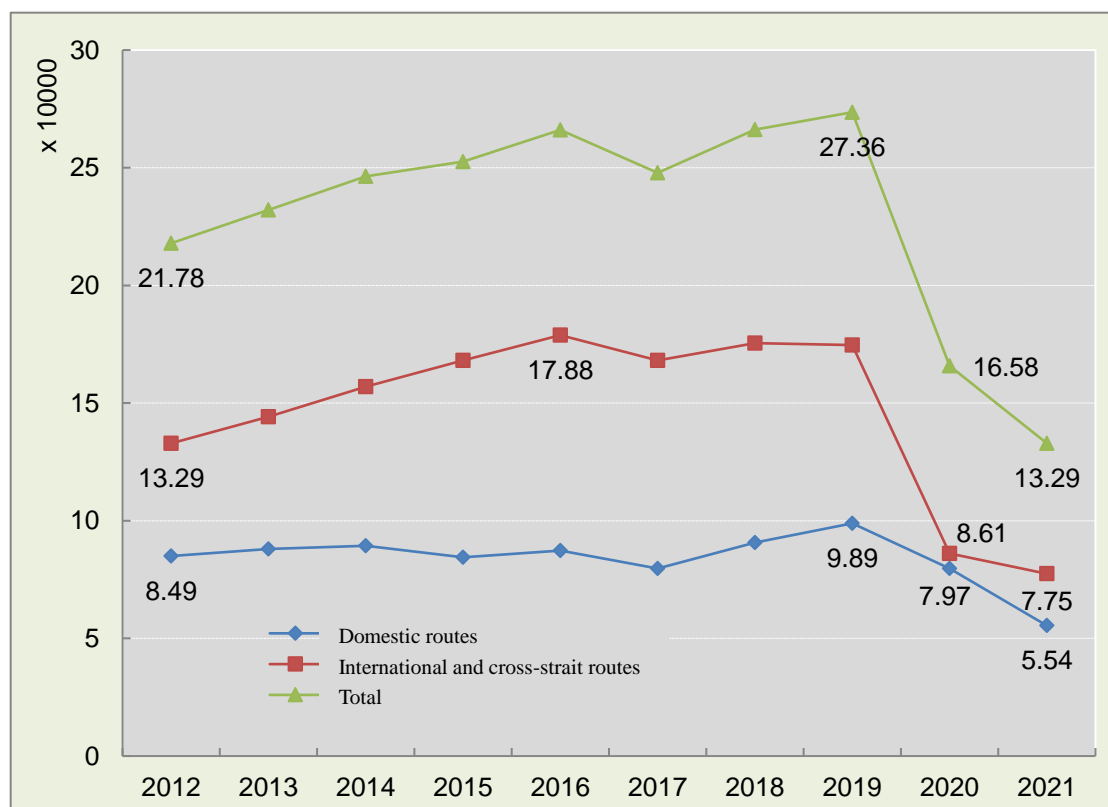


Figure 5 Flights operated by civil air transport carriers

### 1.3 General Aviation Carriers

General aviation carriers in Taiwan logged a total of 3,545.9 flight hours in 2021, a 2.8% increase from 2020. Trends in the flight hours of general aviation carriers in Taiwan from 2012 to 2021 are presented in Figure 6<sup>8</sup>; over the 10-year period in question, the number of flight hours of general aviation carriers exhibited a general downward trend from 2012 to 2017 followed by a sharp increase to a maximum of 5,476.7 hours in 2018 and then a modest decline over the 2 years that followed; the overall 10-year decline rate was 18.2%.

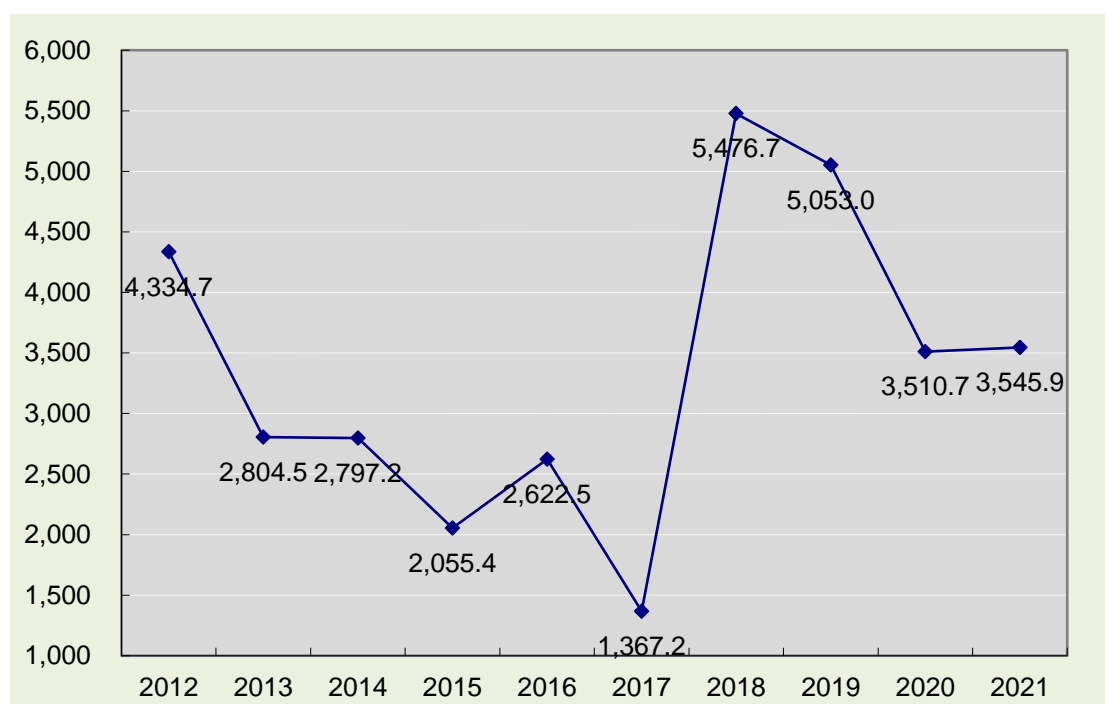


Figure 6 Flight hours logged by general aviation carriers

### 1.4 Ultralight Vehicles

The Ministry of Transportation and Communications amended the Civil Aviation Act in 2003 to include articles on ultralight vehicles. In 2004, regulations regarding ultralight vehicles were promulgated to officially incorporate ultralight vehicles into the ministry’s oversight procedures.

By the end of 2021, the Civil Aeronautics Administration (CAA) had announced 22 airspaces for ultralight vehicles, 10 approved active airspaces, 7 airfields available for legal flying activities,<sup>9</sup> and 8 groups that could legally engage in flying activities

<sup>8</sup> The general aviation carrier flight hours reported in the 2017 CAA Civil Aviation Statistics listed only the flight hours of Daily Air and Emerald Pacific Airlines and not those of other general aviation carriers.

<sup>9</sup> These spaces are located in Huatong, Hualien County; Jiho, Pingtung County; Wang’an, Penghu County; Matai’an, Hualien County; Wuri, Taichung City; Shoufeng, Hualien County; and Xizhou,



with ultralight vehicles.<sup>10</sup> A total of 55 ultralight vehicles passed inspection.

## 1.5 Drones

The Ministry of Transportation and Communications amended the Civil Aviation Act to include articles on drones to come into effect on March 31, 2020.

The Taiwan Transportation Safety Board (TTSB) amended the Transportation Occurrences Investigation Act on April 24, 2019, to incorporate national drones into its scope of investigation. Occurrences to be reported by the owner or operator of the drone to government authorities are prescribed in the Regulation Governing the Handling of Investigation Procedures for Drone Occurrence, promulgated March 4, 2020.

As of the end of 2021, 75,240 drones had been registered with the CAA.

## 1.6 Flight Training Institutions

Apex Flight Academy was established on September 24, 2014, and was Taiwan's first flight academy to pass the CAA's five-stage review process. Apex's flight operations and maintenance base and training facilities are located at Taitung Fongnien Airport and feature academic and technical training facilities. Moreover, the flight academy employs single- and twin-engine flight training airplanes and flight simulators to provide its students with comprehensive academic and technical training.

As of the end of 2021, Apex Flight Academy had nine registered aircraft, all of which were airworthy.

## 1.7 Free Balloons

Free balloons (including free air balloons and hot air balloons) are lighter-than-air passenger vehicles that are not propelled by machinery and whose ascent and descent are controlled by ballasts and buoyant gas. Consistent with international practices, free balloons are considered "standard aircraft," and in the Aircraft Flight Operation Regulations, the CAA further distinguishes free balloons by operation mode into "free balloon flight operations" and "free balloon tethered activities."

As of the end of 2021, 24 free balloons had received certificates of registration in Taiwan; 12 of these balloons were airworthy.

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Changhua County.

<sup>10</sup> These groups are the Taiwan Taiya Aeronautical Tourism and Development Association, Shun Feng Flying Club, Taiwan Recreational Aviation Association, Chinese Taipei Aviation League, KaiXiang Aerospots Association, Chinese Taipei Powered Paragliding Association, Hualien Ultralight Sports Association, and Hualien Aeronautic Association.

## 1.8 Public Aircraft

In the past, according to variations in mission requirements, public aircraft used by Taiwan's government agencies belonged to the Ministry of Transportation and Communications, the Ministry of the Interior, or the Coast Guard Administration. In June 2005, the National Airborne Service Corps (NASC) was formally established under the Executive Yuan, merging the Airborne Squadron of the National Police Agency, the Preparatory Office of the Airborne Fire Fighting Squadron of the National Fire Agency, the Aviation Team of the CAA of the Ministry of Transportation and Communications, and the Air Patrol Squadron of the Coast Guard Administration. The NASC consolidates the planning and implementation of air search and rescue, disaster relief, emergency medical services, reconnaissance and patrol, and transportation over both land and sea.

As of the end of 2021, the NASC had 23 aircraft, namely 22 helicopters and 1 fixed-wing aircraft. The number of flights and flight hours logged by the NASC over the 10-year period in question, based on statistics provided by the NASC (Appendix 2), are illustrated in Figure 7; after a massive increase in flight hours in 2017, both numbers increased substantially again in 2021, with flights increasing by 15.6% and flight hours increasing by 7.1%.

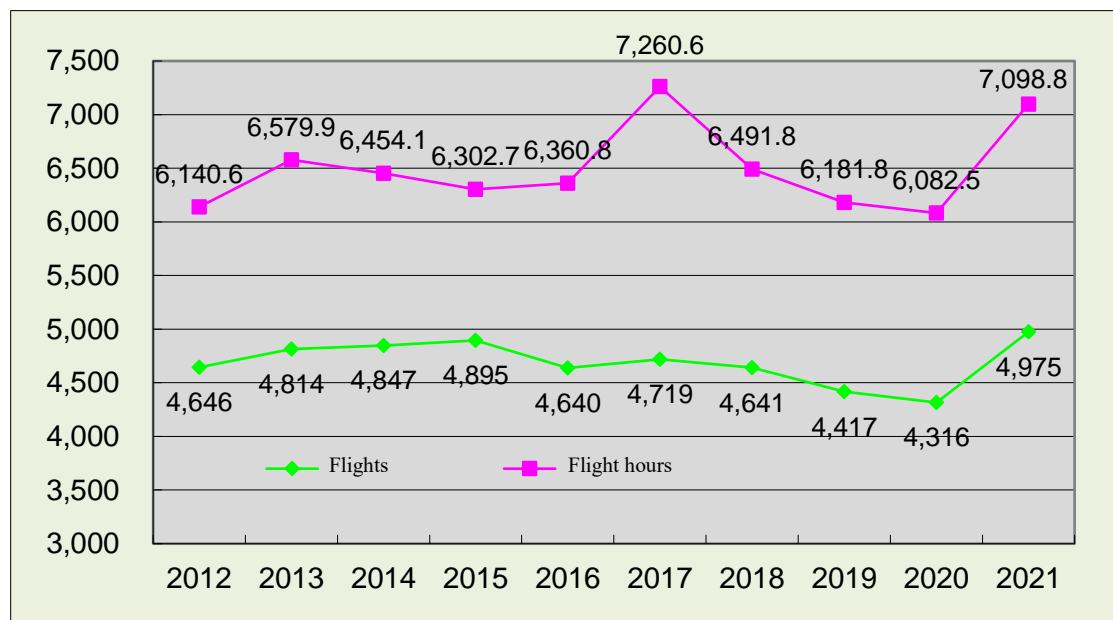


Figure 7 Number of flights and flight hours logged by NASC aircraft

## II. Statistical Analysis of Major Aviation Occurrences

### 2.1 Basic Description

#### Data Source

The data presented in this section were derived from the TTSB's investigational reports on major aviation occurrences, statistics related to aviation safety reported by the CAA, statistics compiled by the NASC, annual safety reports released by the International Air Transport Association (IATA), and annual safety reports published by the International Civil Aviation Organization (ICAO).

#### Definitions and Classifications

The aviation terminology used in this report is defined based on reference to the Civil Aviation Act, the Aircraft Flight Operation Regulations, the Transportation Occurrences Investigation Act, the Regulation Governing the Handling of Investigation Procedures for Civil and Public Aircraft Occurrence, the standard operating procedures of the TTSB, and IATA and ICAO documents (see appendices).

To facilitate comparisons with international occurrence statistics, statistical analyses of civil air transport occurrences were performed according to the classification methods of the IATA,<sup>11</sup> ICAO, and U.S. National Transportation Safety Board (NTSB) as detailed as follows:

- IATA guidelines were used to calculate the hull loss and casualty rates of civil air transportation turbojet and turboprop aircraft with a maximum takeoff weight of 5,700 kg or above, using per million departures over 5 consecutive years<sup>12</sup> as the statistical basis.
- According to the IATA, “hull loss” refers to destruction or substantial damage to an aircraft that is not deemed too costly to repair, and a “fatal accident” is an accident that results in the death of at least one person on board.
- In-flight deaths attributed to natural causes or illness were not included in the calculation of passenger fatalities.
- The ICAO's definitions of “accident,” “flight phase,” and “occurrence taxonomy” were employed for the classification and statistical analysis of Taiwan's major aviation occurrences during the 10-year period in question.

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<sup>11</sup> Data on incident rates released by the CAA use the same categories as those released by the IATA alongside a 5-year moving average to calculate the hull loss rate of civil air transport turbojet and turboprop airplanes with a maximum takeoff weight of 5,700 kg.

<sup>12</sup> Since 2015, the IATA has provided only data related to global departures, not those related to flight times.

- The NTSB’s procedure for accident factor classification was used in the classification and statistical analysis of Taiwan’s major aviation occurrences during the 10-year period in question.

This section includes the 5-year moving averages of hull loss and fatal occurrence rates for public aircraft, general aviation services, and national helicopters in Taiwan. No comparative international statistics were available; thus, these aviation categories are discussed in this paper mainly on the basis of observed trends.

The aviation occurrence rates presented in this report are limited to national aircraft, including the following:

- Turbojet airplanes for civil air transport use, popularly known as commercial turbojet airplanes (maximum takeoff weight of 5,700 kg or above; see Table 1);
- Turboprop airplanes for civil air transport use (maximum takeoff weight of 5,700 kg or above; see Table 2);
- General aviation aircraft (excluding balloons; see Table 3);
- Helicopters (see Table 4); and
- Public aircraft (see Table 5).

Table 1 Civil air transport turbojet airplane models

AIRBUS	BOEING	EMBRAER
A320/321	737	ERJ-190
A330	747	
A350	777	
	787	
	MD-82/83	

Table 2 Civil air transport turboprop airplane models

ATR	DE HAVILLAND (BOMBARDIER)
ATR72	DHC-6

Table 3 General aviation aircraft models

Airplanes		Helicopters
A318/319	EMB-505	AW169
ASTRA-SPX	G280	BELL-206
BD-700	G550	BK-117
BEECH SUPER KING AIR 350/360	G650	
BN-2	HAWKER 400	
Cessna 208B	P2012	
CL-605	P68C	
DA-40NG/42NG		

Table 4 Helicopter models

AW169	BELL-206	BK-117
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Table 5 Public aircraft models

Airplanes	Helicopters
BEECH-200	AS-365
	UH-60M

## 2.2 Overview of major aviation occurrences

National aircraft were involved in four major aviation occurrences in 2021, resulting in two fatalities. One occurrence involved a civil air transport carrier. One involved civil air transport and resulted in substantial damage to the aircraft. Two involved ultralight vehicles; one vehicle experienced total hull loss, and the other received light damage. One occurrence involved total hull loss of a drone. The corresponding statistics are presented in Table 6.

Table 6 Major aviation occurrences in 2021

Category	Aviation occurrences			Fatalities	
	Total cases	Fatal occurrences	Hull loss	Total people	People on board
National civil air transport turbojet aircraft	0	0	0	0	0
National civil air transport turboprop aircraft	1	0	0	0	0
National civil air transport aircraft (total)	1	0	0	0	0
National general aviation aircraft	0	0	0	0	0
Flight training facilities	0	0	0	0	0
Free balloons	0	0	0	0	0
Ultralight vehicles	2	1	1	2	2
Public aircraft	0	0	0	0	0
Drones	1	0	1	0	0
<b>Total</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>

From 2012 to 2021, national aircraft were involved in 81 occurrences. Aircraft in the civil aviation category accounted for 46 occurrences (the majority), followed by 12 ultralight vehicle occurrences, 10 general aviation occurrences, 7 public aircraft occurrences, 3 drone occurrences, 2 flight trainer occurrences, and 1 free balloon occurrence. These occurrences resulted in 118 fatalities (Table 7). More details regarding these aviation occurrences can be found in Appendix 3.

Table 7 Statistics of major flight occurrences involving national aircraft over the preceding 10 years

Category	Major flight occurrences			Fatalities	
	Total cases	Fatal occurrences	Hull loss	Total cases	Fatal occurrences
National civil air transport turbojet aircraft	34	0	0	0	0
National civil air transport turboprop aircraft	12	2	2	91	91
National civil air transport aircraft (total)	46	2	2	91	91
National general aviation aircraft	10	4	4	11	11
Flight training facilities	2	0	1	0	0
Free balloons	1	0	0	0	0
Ultralight vehicles	12	4	11	6	6
Public aircraft	7	4	3	10	10
Drones	3	0	3	0	0
Total	81	14	24	118	118

## 2.3 Major Occurrences Involving Civil Air Transport Aircraft

### 2.3.1 Five-Year Moving Occurrence Rates of Turbojet Airplanes

#### Five-Year Moving Averages of the Hull Loss Rate

The TTSB calculates occurrence rates in Taiwan according to their 5-year moving averages to observe flight safety trends and to compare civil air transport occurrence rates with global data from the IATA.

Turbojet airplanes operated by Taiwan's civil air transport carriers have been involved in no hull loss occurrences in the preceding 10 years. As a result, the 5-year moving average for hull loss remained at 0 throughout the period in question. However, the IATA's 5-year moving average for the global turbojet airplane hull loss rate exhibited a downward trend, dropping from 0.32 occurrences per million departures in 2012–2016 to 0.16 occurrences per million departures in 2017–2021 (Figure 8). Please see Appendix 4 for more detailed statistics.

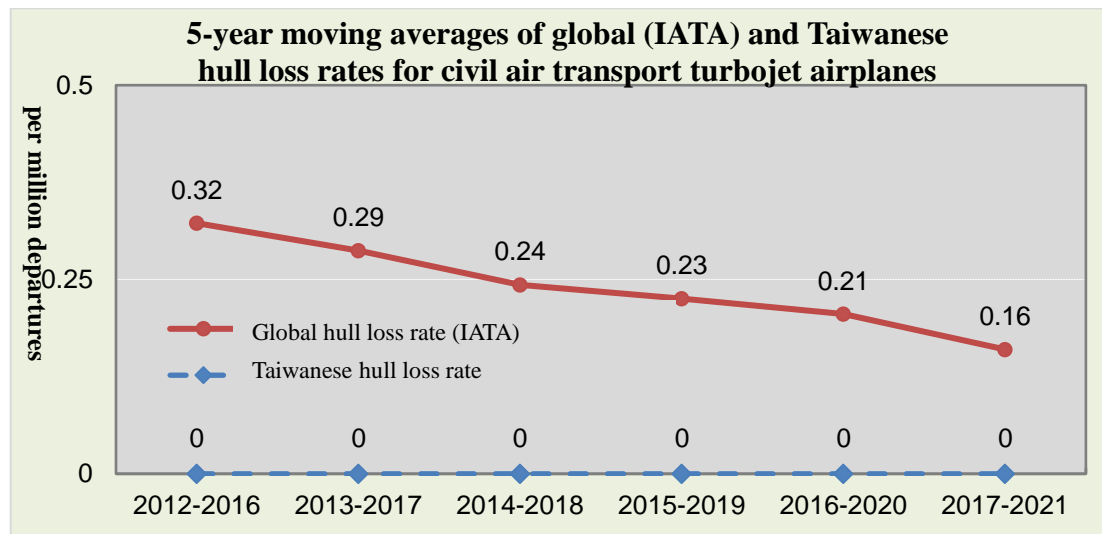


Figure 8 Global (IATA) and Taiwanese hull loss rates for civil air transport turbojet aircraft

### Five-Year Moving Averages of the Fatal Occurrence Rate

Civil air transport turbojet airplanes in Taiwan were involved in no fatalities within the preceding 10 years; therefore, the corresponding 5-year moving average remained at 0 throughout the period in question. The IATA's 5-year moving average for the global rate of fatalities involving turbojet airplanes exhibited an overall downward trend, decreasing from 0.11 occurrences per million departures in 2012–2016 to 0.09 occurrences per million departures in 2013–2017; the rate then rose to 0.12 occurrences per million departures in 2016–2020 period before dropping again to 0.10 occurrences per million departures in 2017–2021 (Figure 9). Please see Appendix 4 for more detailed statistics.

The statistics demonstrated that turbojet airplanes had a higher hull loss rate than fatal occurrence rate given that some cases resulted in hull loss, whereas no cases resulted in fatalities.



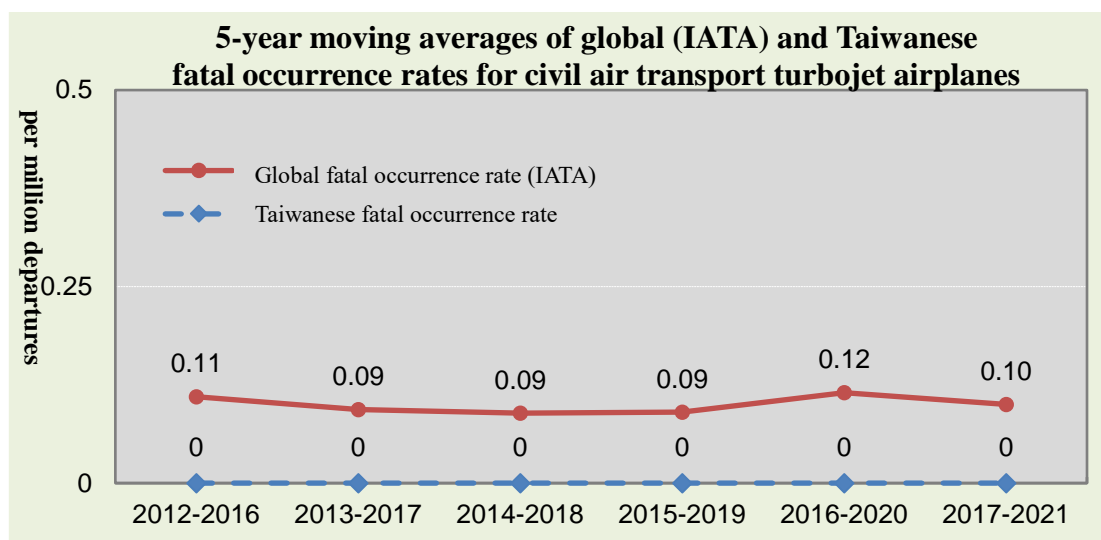


Figure 9 Global (IATA) and Taiwanese fatal occurrence rates for civil air transport turbojet aircraft

### 2.3.2 Five-Year Moving Occurrence Rates of Turboprop Airplanes

#### Five-Year Moving Averages of the Hull Loss Rate

Following aviation occurrences in 2014 and 2015 that resulted in hull loss (TransAsia Airways GE222 and GE235), the 5-year moving average of hull loss occurrences for civil air transport turboprop airplanes for 2012–2016 in Taiwan was 6.18 occurrences per million departures. The moving average then remained within the range of 6.32–6.33 occurrences per million departures for the subsequent 2 years.

As of 2019, the crash of TransAsia flight GE222 in 2014 is no longer included in the moving average; therefore, the 2015–2019 5-year moving average for hull loss occurrences dropped to 3.02 occurrences per million departures. Furthermore, as of 2020, the crash of TransAsia flight GE235 in 2015 is no longer included in the moving average; therefore, the 2016–2020 5-year moving average for hull loss occurrences dropped to 0. No civil air transport turboprop airplanes were involved in hull loss in 2021, and thus the 2017–2021 5-year moving average for hull loss occurrences remained at 0.

The 5-year moving average of the IATA’s global turboprop hull loss occurrence rates trended downward, dropping from 2.19 occurrences per million departures in 2012–2016 to 1.02 occurrences per million departures in 2017–2021 (Figure 10). Please see Appendix 5 for more detailed statistics.

According to the IATA, turboprop airplanes exhibited 6.4 times the hull loss occurrence rate of turbojet airplanes in 2017–2021.

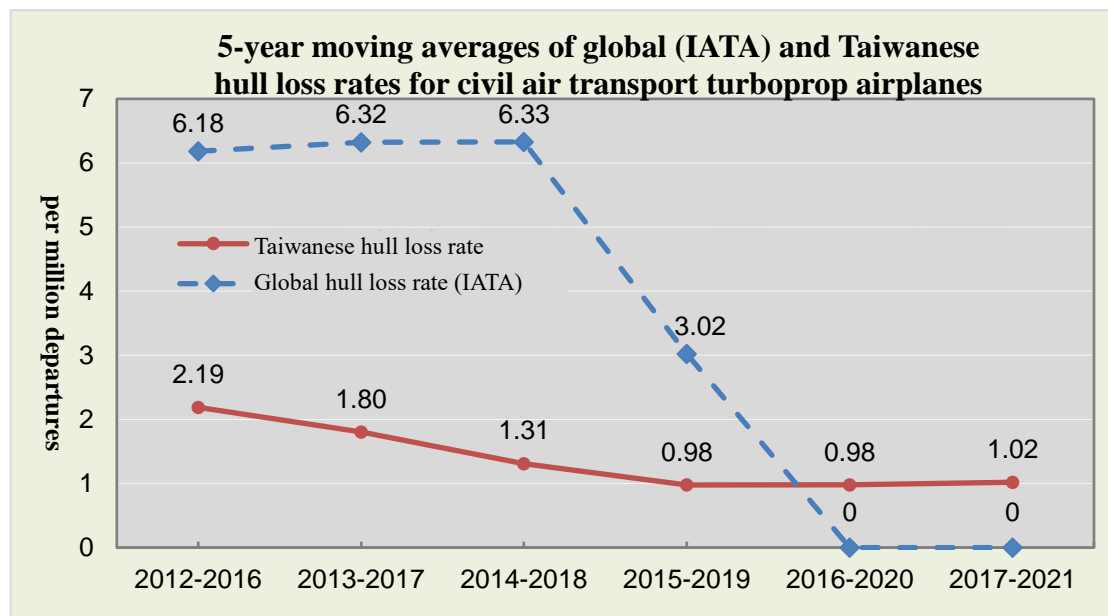


Figure 10 Global (IATA) and Taiwanese hull loss rates for civil air transport turboprop aircraft

### **Five-Year Moving Averages of the Fatal Occurrence Rate**

Following aviation occurrences in 2014 and 2015 that resulted in fatalities (TransAsia flights GE222 and GE235), the 2012–2016 5-year moving average of fatal occurrences for civil air transport turboprop airplanes in Taiwan was 6.18 occurrences per million departures. The moving average then remained within the range of 6.32–6.33 occurrences per million departures for the subsequent 2 years.

As of 2019, the crash of TransAsia flight GE222 in 2014 is no longer included in the moving average; therefore, the 2015–2019 5-year moving average for fatal occurrences dropped to 3.02 occurrences per million departures. Furthermore, as of 2020, the crash of TransAsia flight GE235 in 2015 is no longer included in the moving average; therefore, the 2016–2020 5-year moving average of fatal occurrences dropped to 0. No civil air transport turboprop airplanes were involved in fatal occurrences in 2021, and thus the 2017–2021 5-year moving average for fatal occurrences remained at 0.

The 5-year moving average of the IATA’s global turboprop fatal occurrence rate trended downward, dropping from 1.05 occurrences per million departures in 2012–2016 to 0.64 occurrences per million departures in 2016–2020. This average then increased to 0.77 occurrences per million departures in 2017–2021 (Figure 11). Please see Appendix 5 for more detailed statistics.

According to the IATA, turboprop airplanes exhibited 7.7 times the fatal

occurrence rate of turbojet airplanes in 2017–2021.

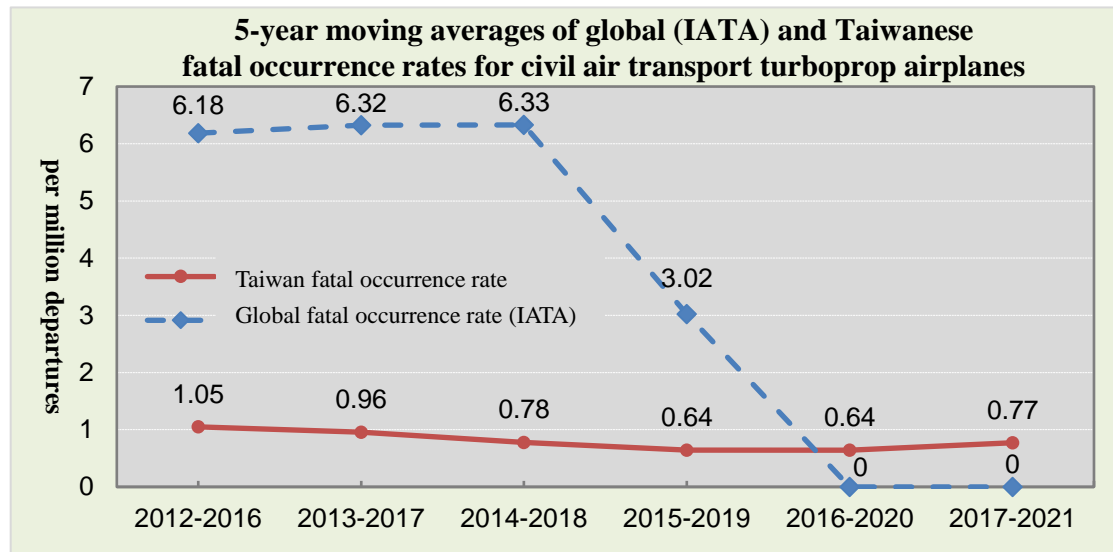


Figure 11 Global (IATA) and Taiwanese fatal occurrence rates for civil air transport turboprop aircraft

### 2.3.3 Annual Airplane Accident Rates

According to the ICAO's definition of an accident (see appendix),<sup>13</sup> ten of the major aviation occurrences involving civil aviation aircraft in the 2012–2021 period<sup>14</sup> are considered accidents (Table 8). Five of these accidents involved turbojet airplanes, resulting in four people acquiring severe injuries. Five of these accidents involved turboprop airplanes, two of which resulted in hull loss, 91 fatalities, and 24 individuals acquiring severe injuries.

Table 8 Civil air transport accidents involving national aircraft over the preceding 10 years

No.	Date	Model		Occurrence location	Flight phase	Damage to aircraft	Fatalities	Injuries
1	2012.05.02	Turboprop	ATR72-500	After taking off from Taipei Songshan Airport	Enroute	Substantial damage	0	0
2	2012.08.17	Turbojet	ERJ-190	Penghu Airport	Landing	Substantial damage	0	0
3	2014.07.23	Turboprop	ATR72-500	Penghu Airport	Approach	Hull loss	48	10
4	2015.02.04	Turboprop	ATR72-600	Keelung River, Nangang (Taipei)	Enroute	Hull loss	43	14
5	2016.10.01	Turbojet	A330-300	Taoyuan International Airport	Landing	Substantial damage	0	0
6	2017.04.13	Turboprop	DHC-6-400	Lanyu Airport, Orchid Island, Taitung (KYD)	Landing	Substantial damage	0	0
7	2017.11.22	Turbojet	B777-300ER	Japanese-controlled airspace	Enroute	None	0	2
8	2017.12.02	Turbojet	B777-300ER	Toronto Pearson International Airport	Taxi	Substantial damage	0	0
9	2019.12.25	Turbojet	A320-200	Airspace above the east coast of Kyushu, Japan	Enroute	None	0	2
10	2021.05.10	Turboprop	ATR72-600	Matsu Nangan Airport	Landing	Substantial damage	0	0

Figure 12 illustrates the number of accidents involving national civil air transport aircraft, the rate of occurrences per million departures, and the ICAO global civil aviation accident rate for 2012 to 2021; please refer to Appendix 6 for more details.

<sup>13</sup> The ICAO includes only fixed commercial flights for profit (including passenger, cargo, and mail services) by fixed-wing aircraft with a maximum takeoff weight of 5,700 kg or above in their calculations of the accident rates of civil aviation carriers.

<sup>14</sup> These ten occurrences include incidents involving national aircraft that occurred and were investigated overseas, except for one incident that happened during a training flight.

Accidents resulting in substantial hull loss or passenger injuries occurred twice in 2012 and thrice in 2017, causing the occurrence rate of Taiwan’s civil air transport aircraft to be higher than the ICAO global average. One occurrence in 2021 resulted in substantial damage to the aircraft, leading to a sharp rise in the occurrence rate, even against a drastic decline in departures due to the global pandemic.

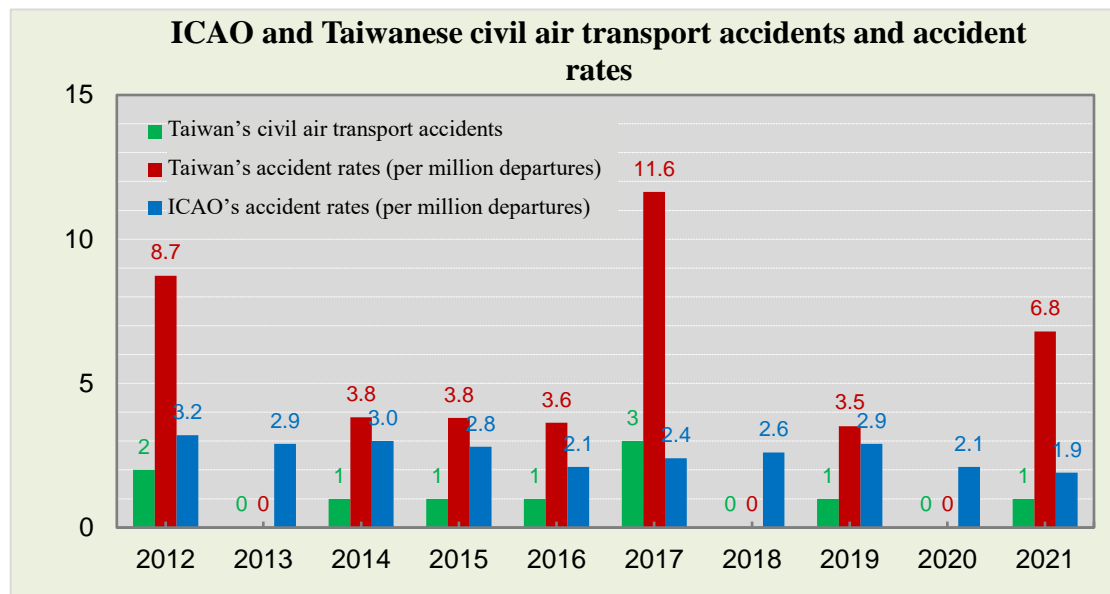


Figure 12 ICAO and Taiwanese statistics regarding civil air transport accidents

### 2.3.4 Classification of Occurrences by Flight Phase

According to the flight phases defined by the ICAO, of the 46 major civil air transport occurrences in the preceding 10 years, 20 happened during the enroute phase (the largest proportion); these occurrences involved abnormal cabin pressure, smoke, turbulence, and engine malfunction. Nine occurrences took place during the landing phase and involved runway excursions, tail strikes, and hard landings. The numbers of occurrences by flight phase are depicted in Figure 13.

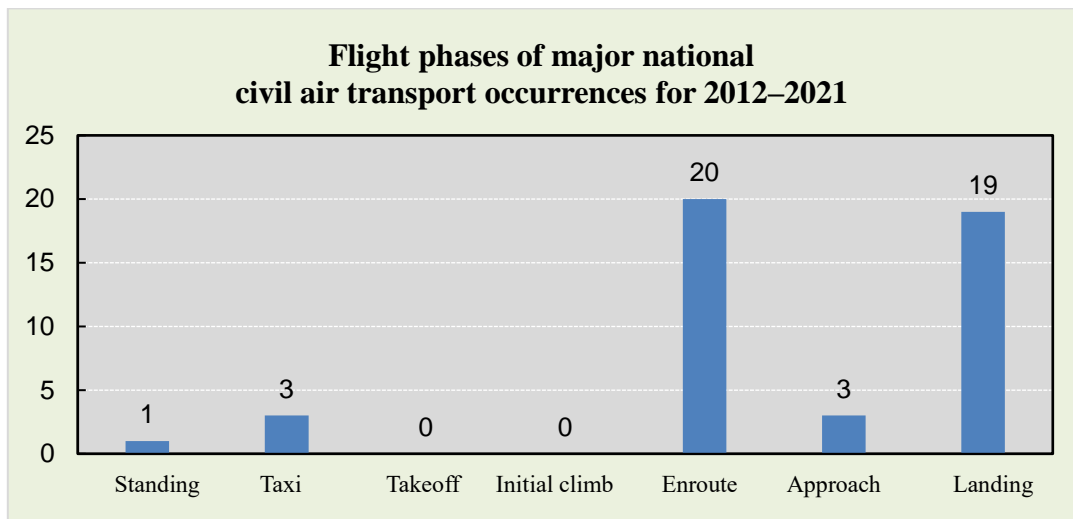


Figure 13 Flight phases of major civil air transport occurrences

### 2.3.5 Occurrence Categories

The ICAO’s occurrence categories are listed in the appendix. Depending on its nature, an aviation occurrence may fit into more than one category; for instance, an engine fire may be categorized as a system/component failure or a malfunction (powerplant) and a fire/smoke incident (nonimpact). An aircraft crash resulting from a loss of control can be categorized as both a system/component failure or a malfunction (nonpowerplant) and a loss of control (inflight).

The categories of the aforementioned 46 major civil air transport occurrences are presented in Figure 14. The statistical results revealed that from 2012 to 2021, runway excursions had the highest occurrence rate, with 13 occurrences, followed by 12 occurrences involving system/component failures or malfunctions (nonpowerplant).

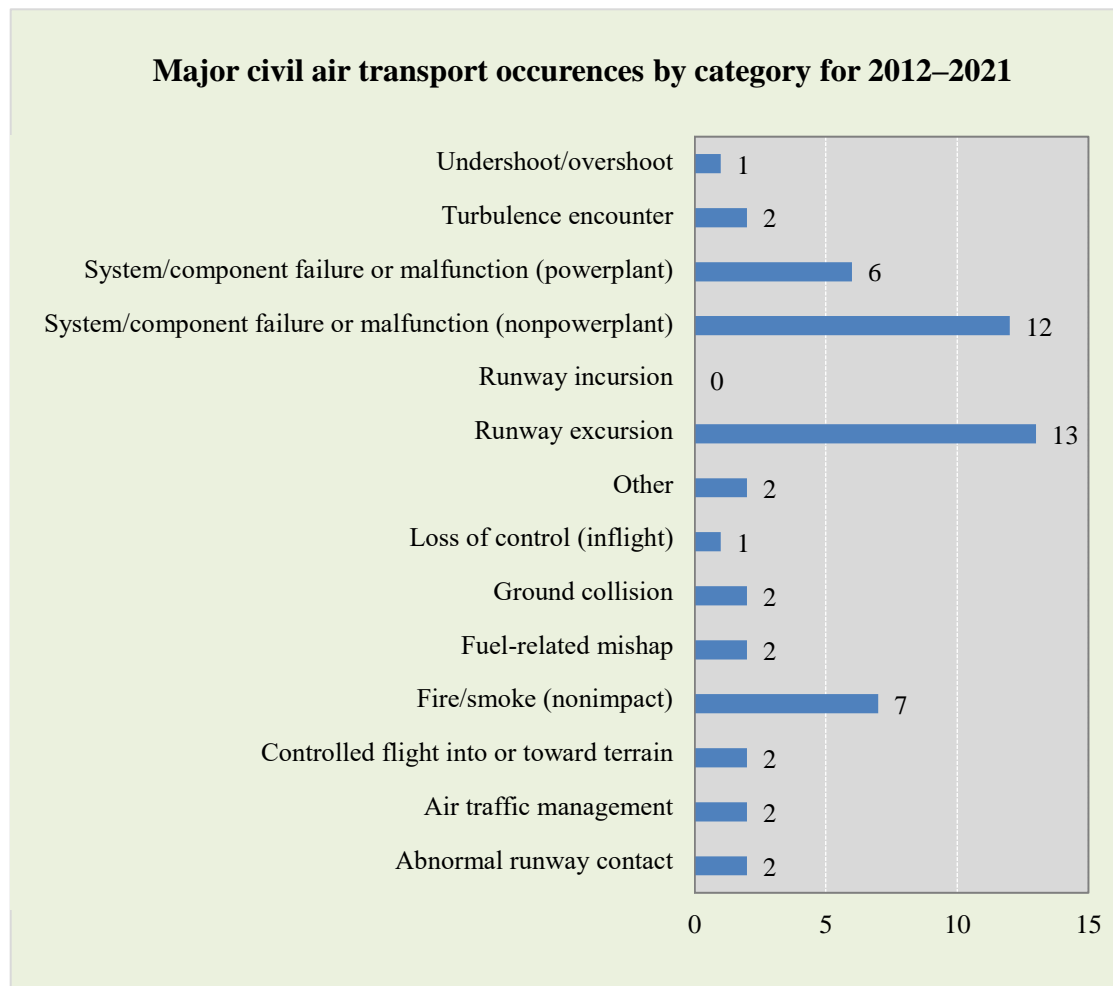


Figure 14 Major civil air transport occurrences by category

### 2.3.6 Occurrence Causes and Factors

The NTSB has three main categories of causes and factors for aviation occurrences, namely human-related, environment-related, and aircraft-related causes. Human-related causes are mainly factors involving pilots and other personnel (e.g., maintenance workers, air traffic control [ATC] staff, organization managers). Environment-related causes and factors are those involving weather; airport, ATC, or navigation facilities; ATC and services; time of day; and terrain. Aircraft-related causes and factors include those involving systems and equipment, engines, structures, and performance.

According to findings of TTSB investigations into possible causes and the NTSB's classification of causes and factors, each occurrence has at least one major cause, and some have two or more causes. For instance, a runway excursion occurrence may include the factors termed "pilot," "weather," and "airport facilities," whereas a cabin pressure failure occurrence may result from "system and equipment" and "maintenance worker" factors.

The statistical results (Figure 15) indicated that over the preceding 10 years, human-related causes and factors were the most prevalent in major civil air transport occurrences, accounting for 67.4% of causes in 31 cases (54.3% pilot related and 13% related to maintenance workers, ground crew, cabin crew, ATC, or other personnel). Environment-related factors were involved in 19 cases, accounting for 41.3% of all causes (28.3% related to the weather and 13.0% related to airport, ATC, or navigation facilities). Aircraft-related causes and factors were present in 17 cases, accounting for 37.0% of all causes (26.1% system and equipment related, 8.7% engine related, and 2.2% structure related). Other factors were involved in two cases, accounting for 4.3%.



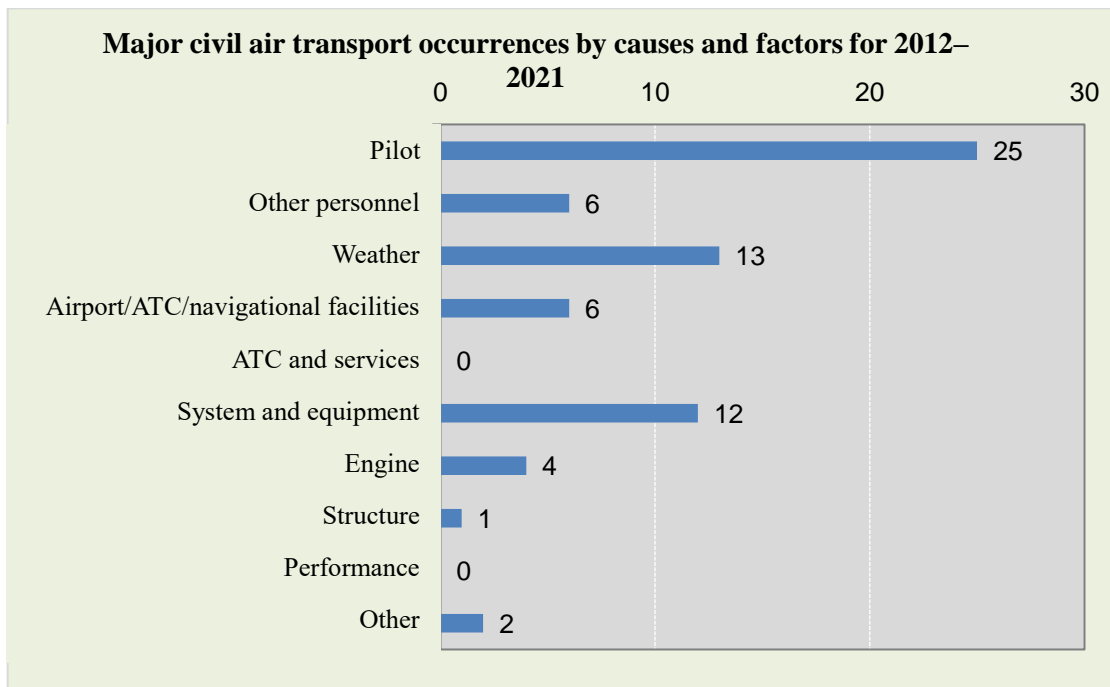


Figure 15 Major civil air transport occurrences by causes and factors

## 2.4 Major Aviation Occurrences in General Aviation Carriers

### Five-Year Moving Average of the Hull Loss and Fatal Occurrence Rates

In 2021, no major aviation occurrences were reported for Taiwan’s general aviation carriers. In the preceding 10 years, four occurrences of hull loss were recorded in 2012, 2013, 2015, and 2017. These four occurrences resulted in fatalities and were therefore considered fatal occurrences; the details are presented in Appendix 3.

The 5-year moving average of the hull loss and fatal occurrence rates for Taiwan’s general aviation carriers exhibited an upward trend prior to 2017, peaking at 2.58 occurrences per 10,000 flight hours. From 2018, the moving average began and then continued to decline, and as of 2021, the 5-year moving average of the hull loss and fatal occurrence rates had dropped to 0.53 occurrences per 10,000 flight hours (Figure 16). The details are presented in Appendix 7.

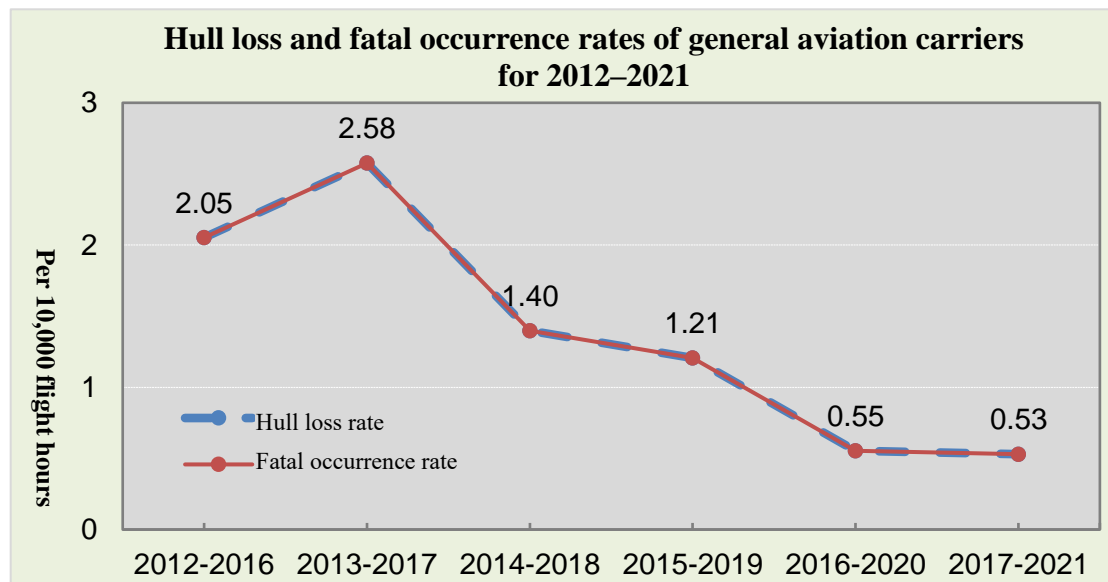


Figure 16 Hull loss and fatal occurrence rates of general aviation carriers

## 2.5 Major Occurrences Involving Helicopters

### Five-Year Moving Average of the Hull Loss and Fatal Occurrence Rates

Taiwan's helicopters were not involved in any major aviation occurrences in 2020. In the preceding 10 years, three occurrences of hull loss were recorded in 2013, 2015, and 2017. All three occurrences resulted in fatalities and were therefore also considered fatal occurrences. The details can be found in Appendix 3.

The 5-year moving average of the hull loss and fatal occurrence rates involving Taiwan's helicopters exhibited an upward trend prior to 2017, peaking at 3.49 occurrences per 10,000 flight hours, or 4.30 occurrences per 10,000 departures. In 2018, the moving average declined to 2.64 occurrences per 10,000 flight hours, or 3.19 occurrences per 10,000 departures, but then increased again in 2019 to 2.86 occurrences per 10,000 flight hours, or 3.40 occurrences per 10,000 departures. Despite the lack of helicopter occurrences since 2017, owing to a decline in flight hours and departures in the preceding 5 years, the 2021 moving average rose to 1.55 occurrences per 10,000 flight hours, or 1.91 occurrences per 10,000 departures (Figure 17). The details are presented in Appendix 8.

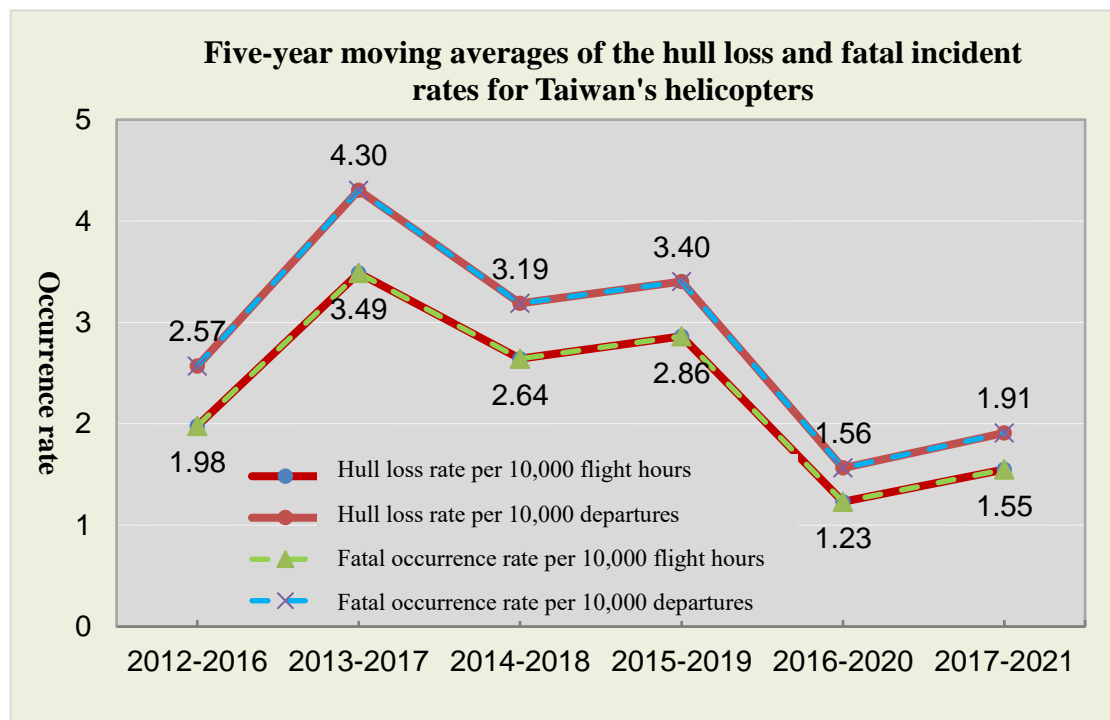


Figure 17 Hull loss and fatal occurrence rates for Taiwan's helicopters

## 2.6 Major Occurrences Involving Public Aircraft

Taiwan’s public aircraft were not involved in any major aviation occurrences in 2020. Over the preceding 10 years, hull loss occurred three times in 2016, 2018, and 2020, with one fatality in 2016 and three in 2018. The details are provided in Appendix 3.

### Five-Year Moving Average of the Hull Loss Rate

The 5-year moving average of the hull loss rate for Taiwan’s public aircraft in 2012–2016 was 0.31 occurrences per 10,000 flight hours, or 0.42 occurrences per 10,000 departures. Subsequently, the moving average exhibited an upward trend, reaching a peak in 2020 of 0.93 occurrences per 10,000 flight hours, or 1.32 occurrences per 10,000 departures, before falling to 0.50 occurrences per 10,000 flight hours, or 0.87 occurrences per 10,000 departures in 2021 (Figure 18). The details are presented in Appendix 19.

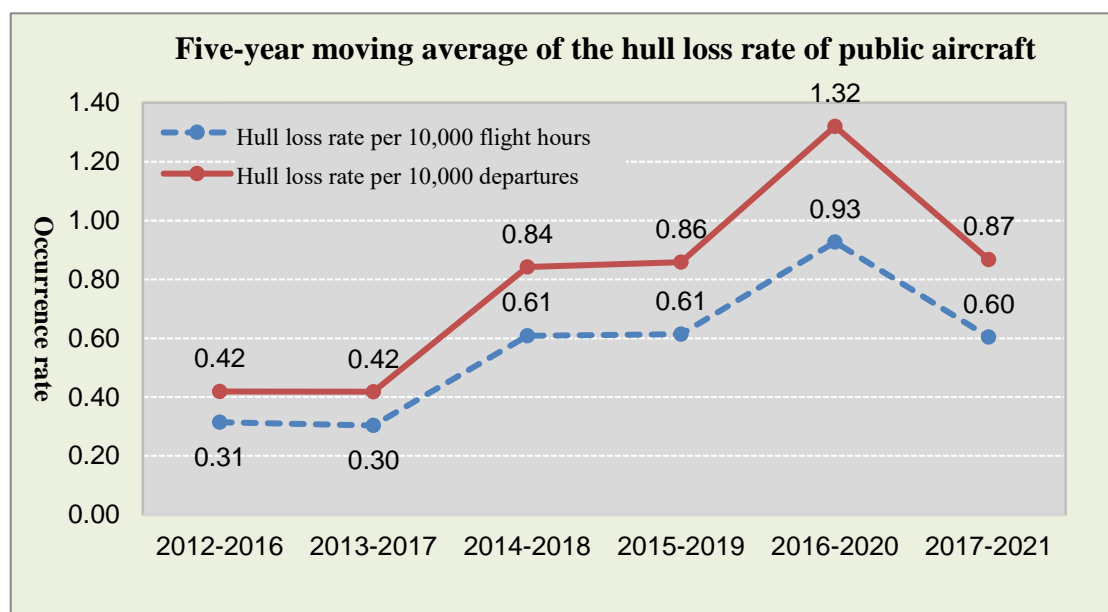


Figure 18 Hull loss rate for public aircraft

### Five-Year Moving Average of the Fatal Occurrence Rate

The 5-year moving average of the fatal occurrence rate for Taiwan’s public aircraft in 2012–2016 was 0.31 occurrences per 10,000 flight hours, or 0.42 occurrences per 10,000 departures. The moving average subsequently exhibited an upward trend and increased substantially after 2018, reaching a peak of 1.24 occurrences per 10,000 flight hours, or 1.76 occurrences per 10,000 departures, in 2020 (Figure 19). The moving average then declined to 0.91 occurrences per 10,000 flight hours, or 1.30 occurrences per 10,000 departures, in 2021. The details are presented in Appendix 9.

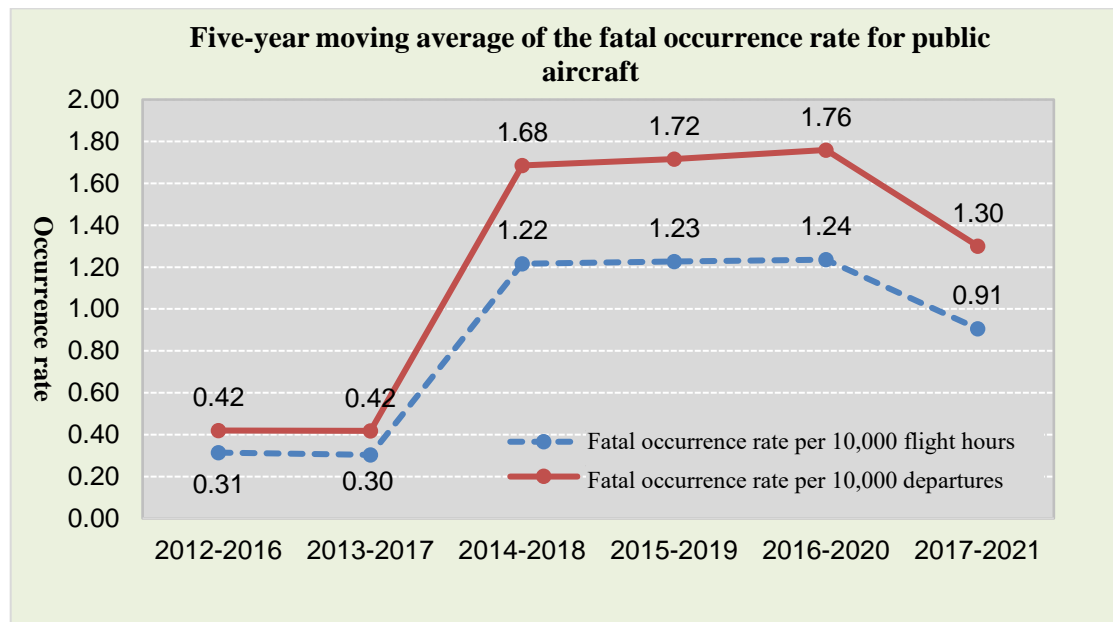


Figure 19 Fatal occurrence rate for public aircraft

## 2.7 Major Occurrences Involving Ultralight Vehicles

In 2004, ultralight vehicles were formally incorporated into the Civil Aviation Act, and major occurrences involving these aircraft were incorporated into the investigative jurisdiction of the TTSB.

Ultralight vehicles were involved in two major occurrences in 2021. Over the preceding 10 years, 12 major aviation occurrences were reported; 11 involved total hull loss, and four were fatal, resulting in six deaths (Figure 20). The details are presented in Appendix 3.

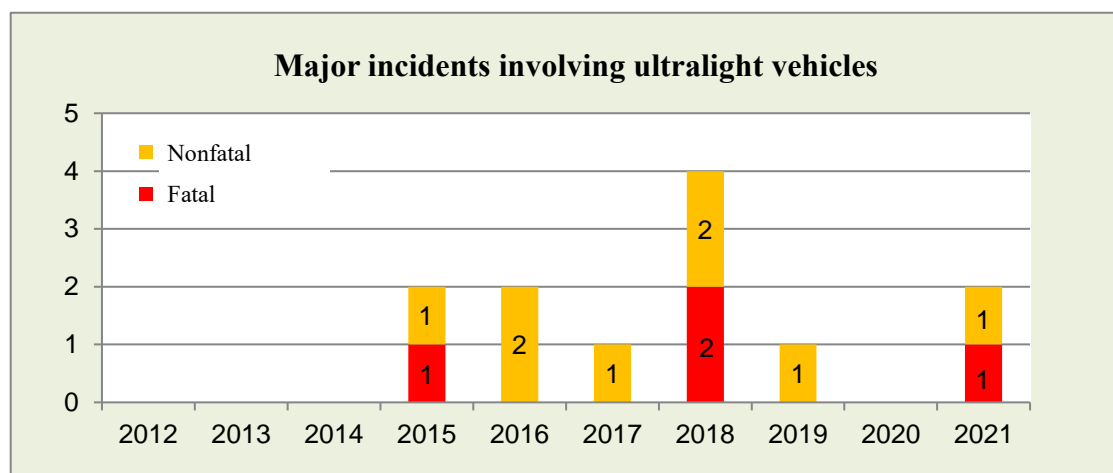


Figure 20 Major occurrences involving ultralight vehicles

## 2.8 Major Occurrences Involving Drones

In March of 2020, drones were formally incorporated into the Civil Aviation Act, and major occurrences involving these aircraft were incorporated into the investigative jurisdiction of the TTSB in April 2019.

Drones were involved in three major aviation occurrences between their incorporation into the investigative jurisdiction of the TTSB (April 2019) and the end of 2021. The third of these occurrences took place in 2021; two vehicles experienced total hull loss, and the other vehicle was declared missing. However, no persons were injured in either occurrence. The details are presented in Appendix 3.

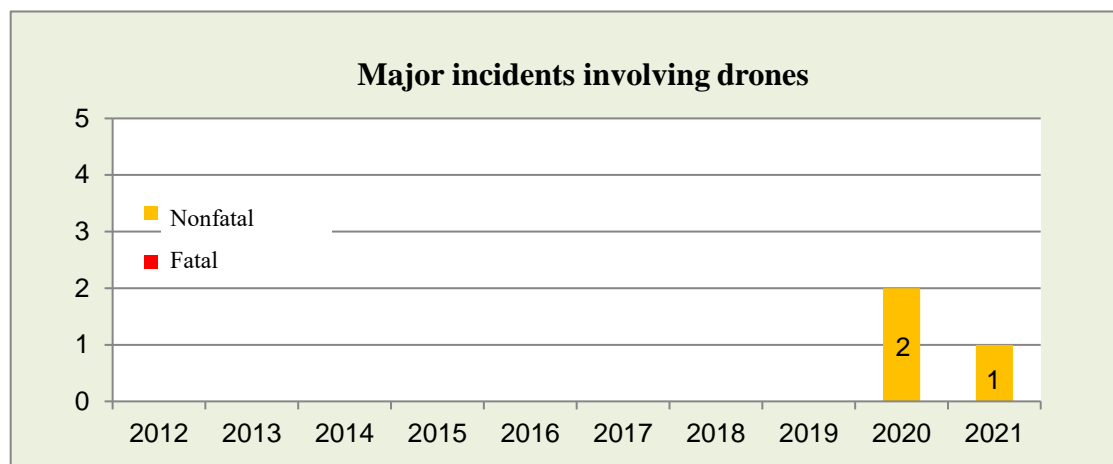


Figure 21 Major occurrences involving drones

### III. Transportation Safety Recommendations and Action Plans

#### 3.1 Categorization of Transportation Safety Recommendations Over the Years

The purpose of systematically investigating transportation occurrences is to determine their causes and provide appropriate recommendations to prevent similar occurrences. Since the establishment of our predecessor, the Aviation Safety Council (1998), as of the end of 2021, the TTSB had investigated 135 major aviation occurrences, and in our reports, we provided 1,087 recommendations to improve transportation safety.

Government-affiliated agencies received the greatest proportion of these recommendations (575 items; approximately 52.9%), followed by aviation businesses (392 items; approximately 36.1%). International institutions received the fewest recommendations (120 items; approximately 11.0%).

Regarding operational categories, civil air transport carriers received the highest proportion of recommendations (650 items; approximately 59.8%), followed by general aviation carriers (217 items; approximately 20.0%), public aircraft (142 items; 13.1%), ultralight vehicles (74 items; 6.8%), and finally drones (4 items; 0.3%), as demonstrated in Table 9 and Figure 21.

Table 9 Categorization of historical transportation safety recommendations

Operational type \ Recipient	Government-affiliated agencies	Airlines	International institutions	Total	Percentage
Civil air transport	300	241	109	650	59.8%
General aviation	102	110	5	217	20.0%
Public aircraft	130	8	4	142	13.1%
Ultralight vehicles	43	29	2	74	6.8%
Drones	0	4	0	4	0.3%
Total	575	392	120	1,087	100%
Percentage	52.9%	36.1%	11.0%	100%	

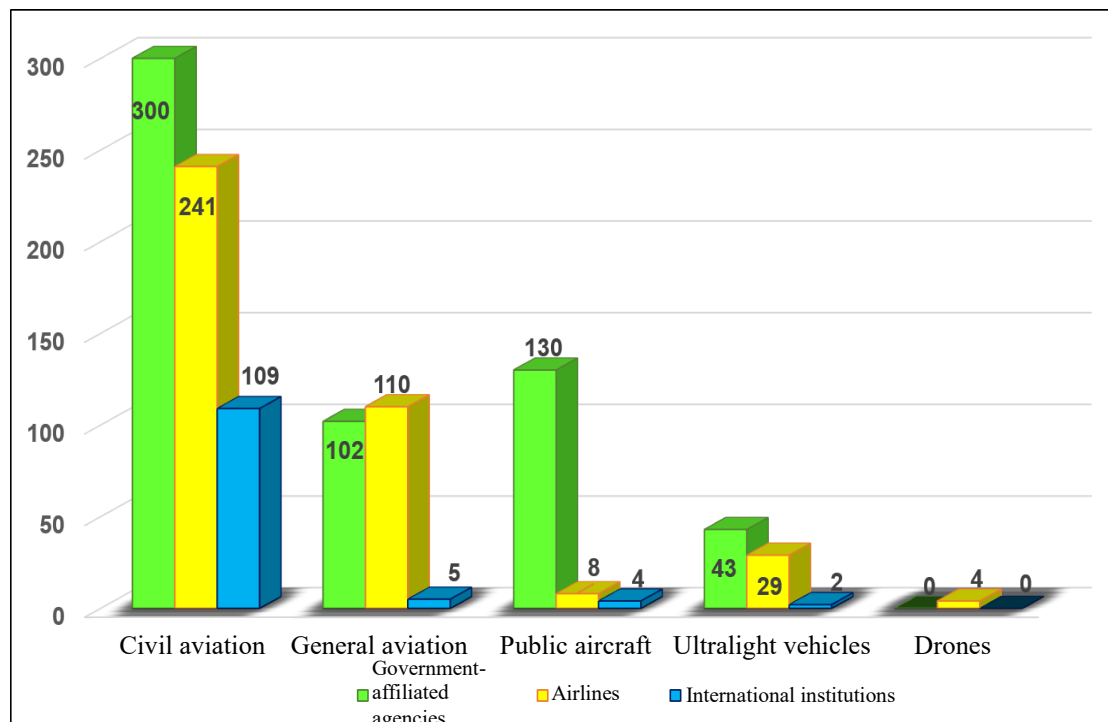


Figure 22 Historical transportation safety recommendations by type

### 3.2 Progress of Actions Plans to Implement Transportation Safety Recommendations

According to Article 27 of the Transportation Occurrences Investigation Act, “The government authorities concerned shall submit a management report to the Executive Yuan within 90 days after the receipt of the transportation occurrence investigation report and send a copy to the TTSB. The management report shall contain detailed and concrete implementation plans in response to the transportation safety recommendations that are considered practicable. In response to the recommendations considered impracticable, detailed reasons shall be provided. The execution of the detailed implementation plans mentioned in Paragraph 1 shall be supervised by the Executive Yuan and tracked by the TTSB.”

Upon being notified by government-affiliated agencies and receiving copies of their action plans, the TTSB shall categorize those action plans according to their implementation statuses. The TTSB suggests that the Executive Yuan accept those action plans in relation to concrete and actionable tasks that have been completed and then close the case in question. For action plans that fail to achieve their improvement targets, the TTSB suggests that the Executive Yuan reject these plans and that the affiliated agencies be asked to resubmit a new plan or supplemental information. If the action plan has a long schedule or must be completed in stages, the TTSB suggests the plan be overseen by the Executive Yuan and that its status be tracked every 6 months



until improvements are completed so that the case may then be closed.

As of the end of 2021, 14 of the 575 aviation safety recommendations remain under the Executive Yuan's oversight (Table 10). Thus, the percentage of concluded recommendations is 97.6%, with all remaining recommendations still under the Executive Yuan's oversight (Figure 22).

Table 10 Transportation safety recommendations being overseen

Items	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected date of completion
1	Corporate Jets, flight N998AM	Address the uncovered V-shaped trenches and enclosure wall on the north and south sides of runways 09 and 27 of Kaohsiung International Airport.	December 31, 2024
2	Mandarin Airlines, flight AE369	Review civil aviation airports and, in accordance with international standards, adopt measures to prevent aircraft wheels from colliding with hard, vertical surfaces of objects within the runway area or ditch covers within the flat zones of precision approach runways when sinking into grassy areas.	December 31, 2024
3-6	Mandarin Airlines, flight AE964	<ol style="list-style-type: none"> <li>The Air Force Command Headquarters under the Ministry of National Defense and the CAA conduct a joint review and improve the drainage performance of the Taichung Airport runway pavement (one task per agency, totaling two tasks).</li> <li>The Taichung Airport by the Air Force Command Headquarters under the Ministry of National Defense and the CAA conduct joint research into the feasibility of installing runway centerline lights (one task per agency, totaling two tasks).</li> </ol>	<ol style="list-style-type: none"> <li>In progress</li> <li>In progress</li> </ol>
7	TransAsia Airways, flight GE222	Review the design process of missed approach positions to raise the probability of the pilot visually identifying the runway environment without compromising the minimum barrier interval height.	December 31, 2022
8	Daily Air, flight DA7507	Review special aerodromes identified as having insufficient runway space to lower	December 31, 2022

Items	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected date of completion
		the risk of damage from aircraft running off the runway by reinforcing runway flatness, limiting aircraft operation conditions, advising carriers to reinforce training regarding insufficient runway practices for flight crews, and expanding existing runways.	
9	Daily Air, flight DA7511	Strengthen airport hazardous risk assessment and control mechanisms and evaluate the priority levels of airport runway improvement projects. For example, prioritize the handling of possible hazards caused by nonfragile objects and open trenches in the runway area as soon as possible to improve runway safety.	December 31, 2022
10	Apex Flight Academy, flight AFA72	Assess the feasibility of adding receiving bases in regions within the automatic dependence surveillance–broadcast range that are affected by the terrain to improve the dynamic surveillance of low-altitude aircraft.	December 31, 2023
11	National Airborne Service Corps, flight NA706	Fortify the identification and navigation functions of the runway lights in reconsideration of the needs of nighttime emergency takeoffs and landings at Lanyu Airport, or strengthen nighttime helipad scheduling and operating procedures if runway facilities cannot be improved.	December 31, 2023
12–14	Mandarin Airlines, flight AE788	1. The Air Force Command Headquarters under the Ministry of National Defense and the CAA jointly improve the cross slope of the Taichung Airport runway pavement (one task per agency, totaling two	1. In progress 2. In progress

Items	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected date of completion
		tasks). 2. Coordinate and cooperate with the CAA to research the installation of runway centerline lights at Taichung Airport.	

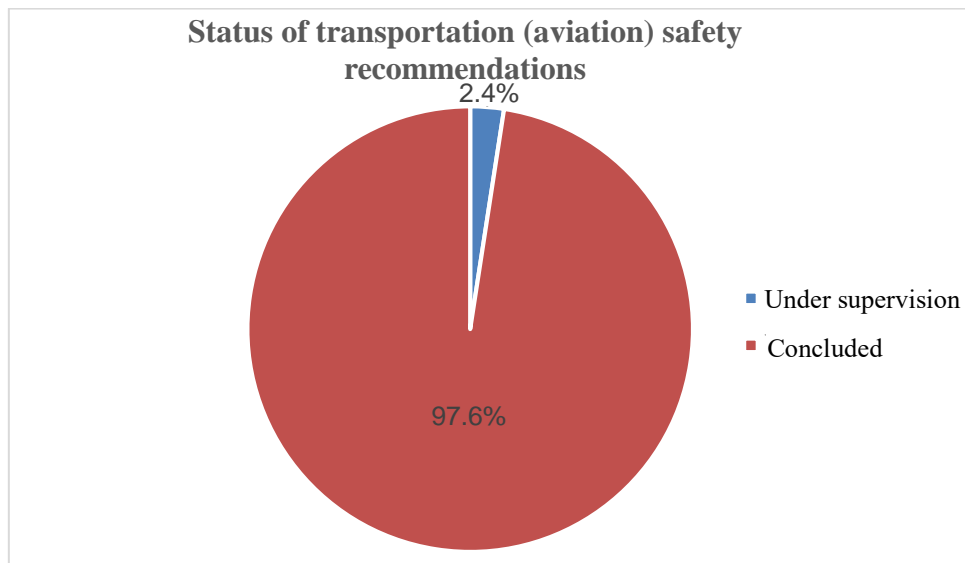


Figure 23 Status of transportation (aviation) safety recommendations

## Appendix Glossary

### Definition of Terms Used in the Civil Aviation Act

Aircraft: any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Aeroplane: a power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Helicopter: a heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

Drone: the unmanned aerial vehicle, the flight control of which is operated by way of signal link through remote control device or which is operated by autopilot, or the other aircraft without human pilot aboard as announced by CAA.

Ultra-light vehicle: a powered airplane, powered glider, gyroplane, powered glider/parachute, or weight-shift-control aircraft (commonly called trikes), which is used for manned operations and meets the following criteria:

1. Single reciprocating engine.
2. A maximum takeoff weight not exceeding six hundred kilograms.
3. A maximum seating capacity not exceeding two persons, including the pilot.
4. A maximum airspeed in level flight with maximum continuous power not exceeding two hundred and twenty two kilometers per hour under standard atmospheric conditions at sea level.
5. A maximum stalling speed, without the use of lift-enhancing devices, not exceeding eighty three kilometers per hour at the aircraft's maximum certificated takeoff weight.
6. A fixed or ground-adjustable propeller other than a powered glider. A fixed or feathering propeller system if a powered glider.
7. A fixed-pitch, teetering and semi-rigid two-blade rotor system if a gyroplane.
8. A non-pressurized cabin, if equipped with a cabin.
9. Fixed landing gear, if installed, other than a powered glider.

Civil air transport enterprise: an undertaking directly engaging in the transportation by aircraft of passengers, cargo and mail for compensation or hire.

General aviation enterprise: an enterprise engaging in the aviation business other than Civil Air Transport Enterprise for compensation, including aerial tourism, survey, photographing, fire-fighting, searching, paramedic, hauling and lifting, spraying and dusting, drone-hauling service, business charter, as well as other authorized aviation service.

Private aircraft activity: a not-for-profit aviation with a privately owned aircraft.

Aircraft accident: an occurrence associated with the operation of aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or associated with the operation of the drone which takes place between the time the propelling system is initiated in preparation for movement with the intention of flight until such time when the flight ends with propelling system being turned off, in which a person, either within or without the aircraft, is fatally or seriously injured or the aircraft sustains substantial damage or structural failure, is missing or completely inaccessible.

Aircraft serious incident: an occurrence associated with the operation of aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all persons aboard have disembarked, or associated with the operation of the drone which takes place between the time the propelling system is initiated in preparation for movement with the intention of flight until such time when the flight ends with propelling system being turned off, which almost result in an accident.

### **Definition of Terms Used in the Aircraft Flight Operation Regulations**

#### Large aircraft

1. Airplane: an airplane of a maximum certificated take-off mass of over 5700 kg.
2. Helicopter: a helicopter of a maximum certificated take-off mass of over 3175 kg.

#### Small aircraft

1. Airplane: an airplane of a maximum certificated take-off mass of over 5700 kg.
2. Helicopter: a helicopter of a maximum certificated take-off mass of over 3175 kg.

Free balloon flight operation: a flight carried out by free balloon involving the transport of passengers.

Free balloon tethered activity: a free balloon which is moored to the surface of the earth or an object.

### **Definition of Terms Used in the Rules of the Air**

Free balloon<sup>15</sup>: non-power-driven, one lighter-than-air aircraft, includes inflatable free balloon and hot-air free balloon.

Hot air balloon<sup>16</sup>: A lighter-than-air aircraft that is not engine-driven and uses hot air for lift. It must pass the certification of the Civil Aviation Administration and has an

<sup>15</sup> Terminology and definition in accordance with Article 2 of the Rules of the Air.

<sup>16</sup> Advisory circular AC91-005D, Mooring and Operations of Hot-Air Balloons, by the CAA Flight Standards Division.

airworthiness certificate before fly.

### **Definition of Terms Used in the Transportation Occurrences Investigation Act**

Major transportation occurrence: major aviation occurrences, railway occurrences, marine occurrences, and highway occurrences that have caused a certain number of injuries, casualties, or property damage or that have caused social concerns and have been identified by the Taiwan Transportation Safety Board.

Transportation occurrence investigation: a process consisting of transportation occurrence identification, factual data gathering, compiling, analysis, probable cause identification, submission of safety recommendations, and investigation report writing.

Investigation report: a report prepared by the Investigator-in-Charge (IIC) compiling submissions from all technical subgroups in accordance with the format administered by the International Civil Aviation Organization and other relevant domestic/foreign organizations, containing factual information, analyses, conclusions, and safety recommendations reviewed and approved under this Act.

Civil aircraft: an aircraft that is used for the purposes of civil air transportation services, general aviation services, pilot training, or private aircraft activities and has completed the process of registration and airworthiness inspection under the civil aviation authorities.

Public aircraft: an aircraft owned or used by a government agency to carry out official duties, excluding military aircrafts administered by the Ministry of Defense.

### **Definition of Terms Used in the Regulation Governing the Handling of Investigation Procedures for Civil and Public Aircraft Occurrence**

Major aviation occurrence: the major aviation occurrences (civil aircraft and public aircraft) specified in the scope of the major transportation occurrences prescribed in the first paragraph of Article 1 of the Act.

Death: the person is in the aircraft, in direct contact with any part of the aircraft, or directly exposed to the airflow caused or caused by the aircraft, and it is not resulting from natural causes, self-induced behaviors, intrusion by another person, or concealment in non-passenger and non-crew seated areas for purposes of illegal immigration. As a result, those who died on the spot or within 30 days of being injured.

Injury: the person is in the aircraft, in direct contact with any part of the aircraft, or directly exposed to the airflow caused or caused by the aircraft, and it is not resulting from natural causes, self-induced behaviors, intrusion by another person, or concealment in non-passenger and non-crew seated areas for purposes of illegal

immigration, who may have one of the following situations:

1. Hospitalization for more than forty-eight (48) hours is required within seven (7) days upon occurrence of the injury.
2. Fracture, excluding that of any finger, toe or nose.
3. Serious bleeding or damage to nerves, muscles or tendons due to laceration.
4. Any harm to an internal organ.
5. Burns of Grade 2 or 3, or more than 5 percent of burns on the skin of the whole body.
6. Confirmed exposure to contaminated substances or harmful radiation.

Substantial damage: adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome).

Missing: Fail to recover the wreckage of the aircraft at the conclusion of the search efforts as determined by the Taiwan Transportation Safety Board.

### **Scope of Major aviation occurrences<sup>17</sup>**

- A. Civil aircraft and public aircraft: associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, and in one of the following situations:
1. Death or injury of any person;
  2. The aircraft sustains substantial damage, is missing, or is completely inaccessible;
  3. Any other situations that may result in fatalities or injuries, or an aircraft occurrence nearly occurred, and are found necessary to be investigated by the TTSB.
- B. Ultra-light vehicle: associated with the operation of an ultra-light vehicle which takes place between the time any person boards the ultra-light vehicle with the intention of flight until such time as all such persons have disembarked, and in one of the following situations:

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<sup>17</sup> Defined by the TTSB in conjunction with the MOTC and then submitted to the Executive Yuan for approval, effective August 1, 2019.



1. Death or injury of any person;
  2. The ultra-light vehicle sustains substantial damage, is missing, or is completely inaccessible;
  3. Other situations that may significantly affect the lives or properties of civilians, and are found necessary to be investigated by the TTSB.
- C. Drone: associated with the operation of a drone which takes place between the time the propelling system is initiated in preparation for movement with the intention of flight until such time when the flight ends with the propelling system being turned off and in one of the following situations:
1. Death or injury of any person;
  2. A drone with maximum takeoff weight exceeding twenty five kilograms sustains substantial damage;
  3. Other situations that may significantly affect the lives or properties of civilians, and are found necessary to be investigate by the TTSB.

### **Definition of Terms Used in the TTSB Standard Operating Procedures**

Transportation safety recommendations: after a transportation (aviation) occurrence investigation, the TTSB proposes recommendations in the investigation report to address transportation safety (aviation safety) concerns discovered in the investigation.

### **IATA Terms and Definitions**

IATA defines an accident as an event where ALL of the following criteria are satisfied:

- Person(s) have boarded the aircraft with the intention of flight (either flight crew or passengers).
- The intention of the flight is limited to normal commercial aviation activities, specifically scheduled/charter passenger or cargo service. Executive jet operations, training, and maintenance/test flights are all excluded.
- The aircraft is turbine-powered and has a certificated maximum takeoff weight of at least 5,700 kg (12,540 lbs.).
- The aircraft has sustained major structural damage exceeding \$1 million or 10% of the aircraft's hull reserve value, whichever is lower, or has been declared a hull loss.

IATA defines hull loss as an accident in which the aircraft is destroyed or substantially damaged and is not subsequently repaired for whatever reason, including a financial decision of the owner.

IATA defines a fatal incident as an accident where at least one passenger or crewmember is killed or later dies of their injuries, resulting from an operational accident. Events such as slips, trips and falls, food poisoning, or injuries resulting from turbulence or involving onboard equipment, which may involve fatalities, but where the aircraft sustains minor or no damage, are excluded.

## ICAO Terms and Definitions

### Accident

An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

- a) a person is fatally or seriously injured as a result of
- being in the aircraft, or- direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or

- direct exposure to jet blast,

**except** when the injuries are from natural causes, self inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew: or

- b) the aircraft sustains damage or structural failure which:

- adversely affects the structural strength, performance or flight characteristics of the aircraft, and

- would normally require major repair or replacement of the affected component,

**except** for engine failure or damage. when the damage is limited to the engine, its cowlings or accessories: or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin: or

- c) the aircraft is missing or is completely inaccessible.

Note 1. For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.

Note 2. An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

### Categorization of Flight Phases

- STANDING (STD) : Prior to pushback or taxi, or after arrival, at the gate, ramp, or parking area, while the aircraft is stationary.
- PUSHBACK/TOWING (PBT) : Aircraft is moving in the gate, ramp, or parking area, assisted by a tow vehicle [tug].
- TAXI (TXI) : The aircraft is moving on the aerodrome surface under its own power prior to takeoff or after landing.

- TAKEOFF (TOF) : From the application of takeoff power, through rotation and to an altitude of 35 feet above runway elevation.
- INITIAL CLIMB (ICL) : From the end of the Takeoff sub-phase to the first prescribed power reduction, or until reaching 1000 feet above runway elevation or the VFR pattern, whichever comes first
- EN ROUTE (ENR) : From completion of Initial Climb through cruise altitude and completion of controlled descent to the Initial Approach Fix (IAF).
- Instrument Flight Rules (IFR) : A set of rules governing the conduct of flight under instrument
- Visual Flight Rules (VFR) : From completion of Initial Climb through cruise and controlled descent to the VFR pattern altitude or 1000 feet above runway elevation, whichever comes first.
- MANEUVERING (MNV) : Low altitude/aerobatic flight operations
- APPROACH (APR) Instrument Flight Rules (IFR) : From the Initial Approach Fix (IAF) to the beginning of the landing flare. Visual Flight Rules (VFR): From the point of VFR pattern entry, or 1000 feet above the runway elevation, to the beginning of the landing flare.
- LANDING (LDG) : From the beginning of the landing flare until aircraft exits the landing runway, comes to a stop on the runway, or when power is applied for takeoff in the case of a touch-and-go landing
- EMERGENCY DESCENT (EMG) : A controlled descent during any airborne phase in response to a perceived emergency situation.
- UNCONTROLLED DESCENT (UND) : A descent during any airborne phase in which the aircraft does not sustain controlled flight.
- POST-IMPACT (PIM) : Any of that portion of the Flight which occurs after impact with a person, object, obstacle or terrain.
- UNKNOWN (UNK) : Phase of flight is not discernable from the information available.

#### Occurrence Category<sup>18</sup>

- ABNORMAL RUNWAY CONTACT (ARC)
- ABRUPT MANEUVER (AMAN)
- AERODROME (ADRM)
- AIRPROX/TCAS ALERT/LOSS OF SEPARATION/NEAR MIDAIR COLLISIONS/ MIDAIR COLLISIONS (MAC)
- ATM/CNS (ATM)

<sup>18</sup> As of 2018, occurrence categories refer to the 2017 version, not the 2004 version.

- BIRD (BIRD)
- CABIN SAFETY EVENTS (CABIN)
- COLLISION WITH OBSTACLE(S) DURING TAKEOFF AND LANDING (CTOL)
- CONTROLLED FLIGHT INTO OR TOWARD TERRAIN (CFIT)
- EVACUATION (EVAC)
- EXTERNAL LOAD RELATED OCCURRENCES (EXTL)
- FIRE/SMOKE (NON-IMPACT) (F-NI)
- FIRE/SMOKE (POST-IMPACT) (F-POST)
- FUEL RELATED (FUEL)
- GLIDER TOWING RELATED EVENTS (GTOW)
- GROUND COLLISION (GCOL)
- GROUND HANDLING (RAMP)
- ICING (ICE)
- LOSS OF CONTROL-GROUND (LOC-G)
- LOSS OF CONTROL-INFLIGHT (LOC-I)
- LOSS OF LIFTING CONDITIONS EN ROUTE (LOLI)
- LOW ALTITUDE OPERATIONS (LALT)
- MEDICAL (MED)
- NAVIGATION ERRORS (NAV)
- OTHER (OTHR)
- RUNWAY EXCURSION (RE)
- RUNWAY INCURSION (RI)
- SECURITY RELATED (SEC)
- SYSTEM/COMPONENT FAILURE OR MALFUNCTION (NON-POWERPLANT) (SCF-NP)
- SYSTEM/COMPONENT FAILURE OR MALFUNCTION (POWERPLANT) (SCF-PP)
- TURBULENCE ENCOUNTER (TURB)
- UNDERSHOOT/OVERSHOOT (USOS)
- UNINTENDED FLIGHT IN IMC (UIMC)
- UNKNOWN OR UNDETERMINED (UNK)
- WILDLIFE (WILD)
- WIND SHEAR OR THUNDERSTORM (WSTRW)

Appendix 1 Operational overview and indicators of national airlines

Time		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
National Airlines	Number of airlines	15	15	18	18	18	16	15	17	17	18	
	Civil air transport carriers	8	8	10	9	9	8	8	9	8	8	
	General aviation carriers	9	9	11	11	11	10	10	11	12	13	
	Number of airworthy aircraft	210	234	249	255	260	263	274	278	270	270	
Civil aviation services	Passenger count	Domestic routes	5,323,750	5,265,923	5,260,693	4,891,621	5,413,680	5,537,976	5,783,596	6,106,070	5,034,365	3,269,669
		International routes	22,546,135	24,061,087	26,704,903	29,042,002	31,226,905	31,135,769	32,147,492	32,411,419	5,185,437	521,058
		Total	27,869,885	29,327,010	31,965,596	33,933,623	36,640,585	36,673,745	37,931,088	38,517,489	10,219,802	3,790,727
	Cargo weight in tons	Domestic routes	49,034	45,651	37,318	39,941	40,491	34,498	35,407	43,009	42,054	33,319
		International routes	1,610,732	1,597,279	1,670,959	1,603,637	1,660,477	2,125,051	2,198,730	2,029,288	2,263,684	2,647,098
		Total	1,659,166	1,642,930	1,708,277	1,643,578	1,700,968	2,159,549	2,234,137	2,072,297	2,305,738	2,680,417
	Number of flights	Domestic routes	84,933	87,939	89,316	84,455	87,257	79,638	90,731	98,887	79,666	55,440
		International routes	132,913	144,135	156,985	168,089	178,842	168,158	175,390	174,695	86,087	77,462
		Total	217,846	232,074	246,301	252,544	266,099	247,796	266,121	273,582	165,753	132,902
	Passenger helicopters	Flight hours	142.85	87.6*	167.2	137.8	148.1	211.3	193.3	122.1	137.4	86.5
		Number of flights	364	184*	440	383	468	646	246	102	268	82
		Passenger count	1,573	972*	2,010	1,852	2,287	3,204	2,735	1,009	1,415	852
General aviation	Flight hours	4,334.7	2,804.5	2,797.2	2,055.4	2,622.5	1,367.2**	5,476.7	5,053.0	3,510.7	3,545.9	
Taiwan national helicopters	Flight hours	3,084	2,090	1,935	1,317	1,675	1,587	1,058	1,347	1,351	1,102	
	Number of flights	2,276	1,842	1,379	1,134	1,152	1,463	1,147	979	871	781	

\* SunRise Airlines operated helicopter passenger services in 2013 from January to October; subsequently, because of the airline's inability to fulfill its contract, the Lianjiang Municipal Government entered into an agreement with Daily Air to carry out helicopter passenger services in November and December of that year. However, Daily Air's flight hours, number of flights, and passenger count were not incorporated into the 2013 civil aviation statistics report

\*\*The 2017 civil aviation statistics report only listed flight hours by Daily Air and Emerald Pacific Airlines and no other data on general aviation carriers.

Appendix 2 National Airborne Service Corps flights and aircraft

Year	Mission type	Total number of flights	Total flight hours	Aircraft type/inventory count			
2012	Air disaster relief Air search and rescue Air emergency medical services Air reconnaissance and patrol Air transportation	4,646	6,140:35	AS-365	10	BE-200	1
				BE-350	1	S-76B	2
				B-234	2	UH-1H	15
2013		4,814	6,579:55	AS-365	10	BE-200	1
				BE-350	1	S-76B	2
				B-234	2	UH-1H	13
2014		4,847	6,454:05	AS-365	10	BE-200	1
				BE-350	1	S-76B	2
				B-234	2	UH-1H	13
2015		4,895	6,302:40	AS-365	10	UH-60M	3
				BEECH	2	S-76B	2
			B-234	2	UH-1H	13	
2016	4,640	6,360:50	AS-365	9	UH-60M	5	
			BEECH	2	UH-1H	6	
2017	4,719	7,260:35	AS-365	9	UH-60M	9	
			BEECH	1	UH-1H	6	
2018	4,641	6,491:50	AS-365	9	UH-60M	8	
			BEECH	1			
2019	4,417	6,181:45	AS-365	9	UH-60M	8	
			BEECH	1			
2020	4,316	6,082:27	AS-365	9	UH-60M	14	
			BEECH	1			
2021	4,975	7,098:45	AS-365	8	UH-60M	14	
			BEECH	1			

Notes:

1. This fleet is a consolidation of the Airborne Squadron of the National Police Agency, the Preparatory Office of the Airborne Fire Fighting Squadron of the National Fire Agency, the Aviation Team of the CAA of the Ministry of Transportation and Communications, and the Air Patrol Squadron of the Coast Guard Administration into a single agency, the National Airborne Service Corps, established on March 10, 2004, and formalized on November 9, 2005.
2. This table does not include the number of flight and flight hours by helicopters rented by the Air Patrol Squadron of the Coast Guard Administration.
3. The 2019 inventory of aircraft only includes serviceable aircraft as of December 31.

Appendix 3 Basic data on major aviation occurrences involving national aircraft

Civil air transport carriers

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
1	2012.03.25	EVA Air	B747-400	B-16411	BR702	None	0	0	Enroute	SCF-NP	System and equipment	Emergency descent due to the automatic function of the left outflow valve and abnormal cabin pressure during the initial climb
2	2012.05.02	TransAsia Airways	ATR72-500	B-22810	GE515	Substantial damage	0	0	Enroute	SCF-PP	Engine	Fire alarm in the left engine during the climbing process
3	2012.05.16	Far Eastern Air Transport	MD-82	B-28037	FE025	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Penghu Airport
4	2012.05.30	EVA Air	B747-400F	B-16481	BR661	Light damage	0	0	Taxi	GCOL	Pilot	While taxiing at O'Hare International Airport, the tip of the right wing collided with the empennage of another aircraft
5	2012.08.12	China Airlines	A330-300	B-18352	CI680	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Taoyuan International Airport
6	2012.08.17	Mandarin Airlines	ERJ-190	B-16825	AE369	Substantial damage	0	0	Landing	RE	Pilot, airport facility	Runway excursion while landing at Penghu Airport, resulting in damage to the nose wheel landing gear
7	2012.08.24	China Airlines	A330-300	B-18353	CI947	None	0	0	Enroute	SCF-NP	System and equipment, pilot, other persons, upkeep	Emergency descent after encountering abnormal cabin pressure while enroute 155 nautical miles northeast of Hong Kong
8	2012.09.13	EVA Air	A330-300	B-16331	BR189	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Songshan Airport
9	2013.02.05	China Airlines	B747-400F	B-18701	CI5254	Light Damage	0	0	Taxi	SCF-PP, F-NI	Engine	Fire alarm for Engine 2 went off while taxiing after landing at Dallas/Fort Worth International Airport
10	2013.05.19	China Airlines	B747-400F	B-18701	CI5254	Light Damage	0	0	Approach	SCF-NP	Structure	The foreflap on the inner edge of the right wing dislodged while the aircraft approached Dallas/Fort Worth International Airport
11	2013.06.03	China	A330-300	B-18317	CI781	None	0	0	Enroute	SCF-NP	System and	Emergency descent after encountering abnormal cabin pressure 110 nautical miles northeast of Ho Chi Minh

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
		Airlines									equipment	City
12	2013.07.01	TransAsia Airways	ATR72-500	B-22806	GE5111	None	0	0	Enroute	SCF-NP, F-NI	System and equipment, pilot	Presence of hot gas in the flight deck during takeoff and climbing while departing from Songshan Airport
13	2013.09.08	China Airlines	B747-400F	B-18716	CI5621	None	0	0	Enroute	SCF-NP	Other persons, upkeep, system and maintenance	Emergency descent after encountering abnormal cabin pressure enroute 41 nautical miles southwest of Penghu Airport
14	2013.10.03	China Airlines	A330-300	B-18358	CI052	None	0	0	Enroute	SCF-PP	Engine	While enroute, Engine 1 exhibited low lubricant levels and abnormal lubricant pressure; after shutting off the engine in the air, the aircraft was diverted to Cairns Airport
15	2014.03.31	China Airlines	B747-400F	B-18721	CI6416	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Taoyuan International Airport
16	2014.04.11	China Airlines	B737-800	B-18601	CI7916	None	0	0	Enroute	SCF-NP, F-NI	System and equipment	Electric arcs and smoke appeared in the passenger cabin ceiling approximately 500 km northwest of Suvarnabhumi Airport
17	2014.06.16	Far Eastern Air Transport	MD-82	B-28017	FE061	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Kinmen Airport
18	2014.07.23	TransAsia Air Transport	ATR72-500	B-22810	GE222	Hull loss	48	10	Approach	CFIT	Pilot, weather	Colliding with a ground barrier while approaching runway 20 of Penghu Airport, then crashing in a residential area
19	2014.09.20	Mandarin Airlines	ERJ-190	B-16821	AE964	None	0	0	Landing	RE	Pilot, weather, airport facility	Runway excursion while landing at Taichung International Airport
20	2014.12.21	Daily Air	DO-228	B-55565	DAC TRN1	Substantial damage	0	0	Landing	ARC	Pilot	Landing gear was not extended while landing at Taitung Airport
21	2015.02.04	TransAsia Air Transport	ATR72-600	B-22816	GE235	Hull loss	43	14	Enroute	SCF-NP, LOC-I	Pilot, system and equipment	Loss of control 3 nautical miles east of Songshan Airport and crashing into Keelung River



Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
22	2015.02.05	Daily Air	DO-228	B-55565	DA7507	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Lanyu Airport
23	2016.04.17	China Airlines	B737-800	B-18609	CI025	None	0	0	Enroute	SCF-PP	System and equipment	Turning back because of abnormal cabin pressure approximately 150 nautical miles northwest of Guam
24	2016.05.06	V Air	A321-200	B-22610	ZV252	None	0	0	Enroute	OTHER, F-NI	Other	Fire and smoke from a passenger's power bank while enroute
25	2016.07.24	TransAsia Air Transport	A320-200	B-22317	GE367	None	0	0	Enroute	SCF-NP, F-NI	System and equipment	Smoke from the water heater in the galley behind the passenger cabin while climbing
26	2016.10.01	China Airlines	A330-300	B-18609	CI704	Substantial damage	0	0	Landing	ARC	Pilot	Tail strike while landing on runway 23R at Taoyuan International Airport
27	2016.12.07	China Airlines	B737-800	B-18605	CI027	None	0	0	Enroute	OTHER, F-NI	Other	Smoke from a passenger's cell phone during the enroute phase
28	2016.12.16	EVA Air	B777-300ER	B-16726	BR015	None	0	0	Enroute	ATM	Other persons – ATC	Near collision with ground barriers when instructed by air traffic control to turn left after taking off from Los Angeles Airport
29	2017.04.13	Daily Air	DHC-6-400	B-55571	DA7511	Substantial damage	0	0	Landing	RE	Pilot, weather, airport facility	Substantial damage to the aircraft due to a runway excursion while landing on runway 13 of Lanyu Airport
30	2017.11.22	EVA Air	B777-300ER	B-16718	BR56	None	0	2	Enroute	TURB	Weather, other persons – passenger	Strong turbulence while enroute 42 nautical miles northeast of Miyazaki Airport
31	2017.12.02	EVA Air	B777-300ER	B-16718	BR35	Substantial damage	0	0	Taxi	GCOL	Pilot, airport facility	While taxiing onto the departure runway at Toronto Pearson International Airport, the right wing collided with a lamppost, resulting in damage to the front edge of the wing
32	2018.04.23	Daily Air	DHC-6-400	B-55573	DA7012	None	0	0	Landing	RE	Pilot	Runway excursion while landing on runway 09 at Kaohsiung International Airport
33	2018.06.21	China Airlines	B747-400F	B-18711	CI5148	None	0	0	Landing	RE	Pilot, navigation facility	Runway excursion and go-around while landing at O'Hare International Airport

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
34	2018.07.02	Far Eastern Air Transport	MD-82	B-28035	FE8026	Light damage	0	0	Enroute	SCF-PP	Engine	Left engine malfunctioning approximately 10 nautical miles from Songshan Airport while on approach
35	2018.07.08	China Airlines	B737-800	B-18667	CI170	None	0	0	Approach	FUEL	Pilot, weather	Declaration of emergency after three go-arounds while approaching Toyama Airport and then rerouted to Nagoya Airport
36	2018.08.22	Mandarin Airlines	ATR72-600	B-16852	AE788	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Taichung International Airport
37	2018.10.19	China Airlines	B747-400F	B-18719	CI5880	None	0	0	Standing	SCF-NP	System and equipment, other persons, ground handling	Tire explosion when performing tire pressurization at Singapore Changi Airport
38	2018.12.14	China Airlines	B747-400F	B-18717	CI6844	None	0	0	Landing	USOS	Pilot	Undershooting the runway while landing on runway 05L of Taoyuan International Airport
39	2018.12.22	EVA Air	B777-300ER	B-16716	BR61	None	0	0	Enroute	ATM	Pending	Approaching flights NCR840 and KLM875 while in airspace under control of Delhi, India
40	2019.03.09	China Airlines	B747-400	B-18211	CI122	None	0	0	Enroute	FUEL	Pilot	Fuel distress occurring prior to landing at Taoyuan International Airport
41	2019.04.20	Far Eastern Air Transport	ATR72-600	B-28082	FE3060	None	0	0	Landing	RE	Pilot	Brief runway excursion while landing at Taichung International Airport
42	2019.05.02	Mandarin Airlines	ATR72-600	B-16851	AE7931	None	0	0	Enroute	SCF-NP	System and equipment	Temporary loss of pressure in the passenger cabin during the descent
43	2019.05.30	China Airlines	A330-300	B-18352	CI922	None	0	0	Enroute	SCF-PP, F-NI	Other persons—maintenance	Engine fire alarm at cruising level 250 after departing Hong Kong International Airport and returning to Hong Kong
44	2019.12.25	Tigerair	A320-200	B-50001	IT237	None	0	2	Enroute	TURB	Weather	Encountered turbulence while passing through the airspace above the eastern shore of Kyushu, Japan,

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
		Taiwan										resulting in severe injuries to two cabin crew members
45	2020.06.14	China Airlines	A330-300	B-18302	CI202	None	0	0	Landing	SCF-NP	System and equipment	Multiple system failures while landing at Songshan Airport
46	2021.05.10	UNI Air	ATR72-600	B-17010	B79091	Substantial damage	0	0	Landing	CFIT	Pilot	Go around at Matsu Nangan Airport after the main wheels and tail skid collided with the top outer edge of the pre-threshold area of runway 21 and returned to Songshan Airport

General Aviation Carriers

Order	Date	Airline	Aircraft model	Registration number	Operation	Damage to aircraft	Fatalities	Serious injuries	Report title
1	2012.08.30	Roc Aviation Company	BN-2	B-68801	Aerial photography	Hull loss	3	0	Crashed during an aerial surveying operation in the Hualien mountains
2	2013.10.16	SunRise Airlines	BK117-B2	B-77009	Supply	Hull loss	3	0	Crashed while landing on the Yushan Beifeng parking apron during a supply operation
3	2014.03.25	Executive Aviation	Hawker 400XP	B-95995	Chartered flight	None	0	0	Erroneous landing at Matsu Beigan Airport
4	2014.12.18	Emerald Pacific Airlines	Bell-206B3	B-31019	Obstacle sweep	Substantial damage	0	0	Crash landing after losing power while cleaning electric tower insulation barriers in Changhua County
5	2015.04.16	Roc Aviation Company	BN-2B-20	B-68802	Flyover	None	0	0	Returning to Taitung Airport because of engine failure after take off
6	2015.11.22	Emerald Pacific Airlines	Bell-206B3	B-31127	Obstacle sweep	Hull loss	2	0	Crashed during an electric tower obstacle sweeping operation in the Taishan District of New Taipei City
7	2017.06.10	Emerald Pacific Airlines	Bell-206B	B-31118	Aerial photography	Hull loss	3	0	Crashed during an aerial photography operation in Fengbin Township, Hualien County
8	2018.03.15	Aerospace Industrial Development Corporation	Astra-SPX	B-20001	Tow target	None	0	0	Brief runway excursion while landing at Taichung International Airport

National helicopters

Order	Date	Airline	Aircraft model	Registration number	Operation	Damage to aircraft	Fatalities	Serious injuries	Report title
1	2013.10.16	Sunrise Airlines	BK117-B2	B-77009	Supply	Hull loss	3	0	Crashed while landing on the Yushan Beifeng parking apron during a supply operation
2	2014.12.18	Emerald Pacific Airlines	Bell-206B3	B-31019	Obstacle sweep	Substantial damage	0	0	Crash landing after losing power while cleaning electric tower insulation barriers in Changhua County
3	2015.11.22	Emerald Pacific Airlines	Bell-206B3	B-31127	Obstacle sweep	Hull loss	2	0	Crashed during an electric tower obstacle sweeping operation in the Taishan District of New Taipei City
4	2017.06.10	Emerald Pacific Airlines	Bell-206B	B-31118	Aerial photography	Hull loss	3	0	Crashed during an aerial photography operation in Fengbin Township, Hualien County

Flight training organizations

Order	Date	Organization	Aircraft model	Registration number	Flight number	Operation	Damage to aircraft	Fatalities	Serious injuries	Report title
1	2016.05.05	APEX	DA-40NG	B-88002	AFA21	Training	Substantial damage	0	0	Damage to the aircraft while landing and bouncing at Taitung Airport
2	2018.07.09	APEX	DA-40NG	B-88123	AFA72	Training	Hull loss	0	0	Crash landing approximately 12 nautical miles southwest of Kaohsiung International Airport because of engine failure during the landing phase

Free balloons

Order	Date	Owner	Aircraft model	Registration number	Operation	Damage to aircraft	Fatalities	Serious injuries	Report title
1	2014.05.18	Taitung County Government	CAMERON C-90	B-00008	Free balloon flight	None	0	1	Ground crew was injured by falling from the basket during balloon movement in Yong'an Village, Luye Township, Taitung County

Public aircraft

Order	Date	Owner	Aircraft model	Registration number	Operation	Damage to aircraft	Fatalities	Serious injuries	Report title
1	2015.11.07	NASC	King Air BE-350	NA-302	Aerial photography	Substantial damage	0	0	Damage to aircraft from landing on its belly after landing gear collapsed while landing at Taichung International Airport
2	2016.03.11	NASC	AS365N3	NA-107	Supply	Hull loss	2	3	Crashing into the ocean while performing personnel suspension offshore in Shimen District, New Taipei City
3	2017.06.30	NASC	UH-60M	NA-703	Training	None	0	1	Personnel injury from falling into the ocean during training at Taichung Port
4	2018.02.05	NASC	UH-60M	NA-706	Medical evacuation	Hull loss	6	0	Crashing into the ocean after taking off from Lanyu Airport
5	2018.11.04	NASC	AS365N2	NA-104	Suspension rescue	None	1	0	Personnel falling into the ocean during suspension operations approximately 2.5 nautical miles outside Kaohsiung Port
6	2018.12.05	NASC	AS365N3	NA-106	Suspension rescue	None	1	0	Death of personnel from injuries while performing suspension operations
7	2020.04.07	NASC	AS365N2	NA-103	Training	Hull loss	0	0	Crash while executing a simulation of tail rotor failure protocols

Ultra-light vehicles

Order	Date	Activity Group	Aircraft model	Registration number	Aircraft damage	Fatalities	Serious injuries
1	2015.03.16	Taiwan Ultra-Light Flights Development Association	RANS S-6 COYOTE II	PA-2002	Hull loss	2	0
2	2015.06.21	Taiwan Aviators Sports Association	HAWK ARROW II	None	Hull loss	0	1
3	2016.02.20	None	Super Bingo	None	Hull loss	0	0
4	2016.11.17	KaiXiang Aerosports Association	Remos GX	AJ-2666	Hull loss	0	1
5	2017.03.11	None	Storch	None	Hull loss	0	1
6	2018.01.06	None	N/A	None	Hull loss	0	0
7	2018.07.08	None	Skylark IIS	None	Hull loss	0	2
8	2018.09.02	None	N/A	None	Hull loss	1	0
9	2018.09.14	Chinese Taipei Powered Paragliding Association	LIFT M	PM-1052	Hull loss	1	0
10	2019.01.27	None	APCO LIFT EZ S	None	Hull loss	0	1
11	2021.01.07	KaiXiang Aerosports Association	Flight Design CTLSi	AJ-2199	Hull loss	2	0
12	2021.04.23	None	APCO THRUST HP S	None	Light damage	0	1

Drones

Order	Date	Activity Group	Aircraft model	Registration number	Aircraft damage	Fatalities	Serious injuries
1	2020.02.07	GEOSAT Aerospace & Technology Inc.	Sky Arrow 55	Not applicable*	Hull loss	0	0
2	2020.06.17	Coast Guard Administration of the Ocean Affairs Council, Southern Branch	AXH-E230RS	B-AAA01403	Missing	0	0

Order	Date	Activity Group	Aircraft model	Registration number	Aircraft damage	Fatalities	Serious injuries
3	2021.03.09	Coast Guard Administration of the Ocean Affairs Council, Northern Branch	AVIX AXH-E230RS	B-AAA01408	Hull loss	0	0

\* This incident took place before the articles on drones in the Civil Aviation Act took effect (March 31, 2020).



Appendix 4 Global (IATA) and Taiwan hull loss rates for civil air transport turbojet airplanes

Year	Global (IATA)					Taiwan				
	Departure	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate	Departure <sup>19</sup>	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate
	Million occurrences	Occurrences	Per million departures	Occurrences	Per million departures	Occurrences	Occurrences	Per million departures	Occurrences	Per million departures
2012	29.77	8	0.27	N/A	N/A	170,011	0	0.00	0	0.00
2013	29.47	12	0.41	6	0.20	175,518	0	0.00	0	0.00
2014	30.60	7	0.23	3	0.10	192,202	0	0.00	0	0.00
2015	31.40	10	0.32	0	0.00	200,610	0	0.00	0	0.00
2016	33.80	13	0.38	5	0.15	212,403	0	0.00	0	0.00
2017	35.00	4	0.11	1	0.03	205,955	0	0.00	0	0.00
2018	37.70	7	0.19	6	0.16	209,582	0	0.00	0	0.00
2019	39.60	6	0.15	4	0.10	200,666	0	0.00	0	0.00
2020	19.10	4	0.21	3	0.16	110,240	0	0.00	0	0.00
2021	22.90	3	0.13	1	0.04	99,980	0	0.00	0	0.00
2012-2016	155.04	50	0.32	N/A	0.11	950,744	0	0.00	0	0.00
2013-2017	160.27	46	0.29	15	0.09	986,688	0	0.00	0	0.00
2014-2018	168.50	41	0.24	15	0.09	1,020,752	0	0.00	0	0.00
2015-2019	177.50	40	0.23	16	0.09	1,029,216	0	0.00	0	0.00
2016-2020	165.20	34	0.21	19	0.12	938,846	0	0.00	0	0.00
2017-2021	154.30	24	0.16	15	0.10	816,423	0	0.00	0	0.00

<sup>19</sup> Source: [Aviation safety statistics](#) for Taiwan civil aviation turbojet airplanes, released on the official CAA website.

Appendix 5 Global (IATA) and Taiwan hull loss rates for civil air transport turboprop airplanes

Year	Global (IATA)					Taiwan				
	Departure	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate	Departure <sup>20</sup>	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate
	Million occurrences	Occurrences	Per million departures	Occurrences	Per million departures	Occurrences	Occurrences	Per million departures	Occurrences	Per million departures
2012	7.70	24	3.12	N/A	N/A	59,010	0	0.00	0	0.00
2013	6.89	20	2.90	10	1.45	69,615	0	0.00	0	0.00
2014	7.40	17	2.30	9	1.22	69,595	1	14.37	1	14.37
2015	6.20	8	1.29	4	0.65	62,389	1	16.03	1	16.03
2016	7.00	8	1.14	5	0.71	62,838	0	0.00	0	0.00
2017	6.90	9	1.30	5	0.72	51,841	0	0.00	0	0.00
2018	8.40	5	0.60	5	0.60	69,349	0	0.00	0	0.00
2019	7.30	5	0.68	4	0.55	84,229	0	0.00	0	0.00
2020	3.10	5	1.61	2	0.65	64,067	0	0.00	0	0.00
2021	2.80	5	1.79	6	2.14	47,425	0	0.00	0	0.00
2012-2016	35.19	77	2.19	N/A	1.05	323,447	2	6.18	2	6.18
2013-2017	34.39	62	1.80	33	0.96	316,278	2	6.32	2	6.32
2014-2018	35.90	47	1.31	28	0.78	316,012	2	6.33	2	6.33
2015-2019	35.80	35	0.98	23	0.64	330,646	1	3.02	1	3.02
2016-2020	32.70	32	0.98	21	0.64	332,324	0	0.00	0	0.00
2017-2021	28.5	29	1.02	22	0.77	316,911	0	0.00	0	0.00

<sup>20</sup> Source: [Aviation safety statistics](#) for Taiwan civil aviation turboprop airplanes, released on the official CAA website.

Appendix 6 Statistics on civil air transport accidents compiled by the ICAO and Taiwan

Year	ICAO	Taiwan		
	Incident rate	Departure <sup>21</sup>	Incident	Incident rate
	Per million departures	Occurrences	Occurrences	Per million departures
2012	3.2	229,021	2	8.7
2013	2.9	245,133	0	0
2014	3.0	261,797	1	3.8
2015	2.8	262,999	1	3.8
2016	2.1	275,241	1	3.6
2017	2.4	257,796	3	11.6
2018	2.6	278,931	0	0
2019	2.9	284,895	1	3.5
2020	2.1	174,307	0	0
2021	1.9	147,405	1	6.8

<sup>21</sup> Source: [Aviation safety statistics](#) for total departures by Taiwan civil aviation turbojet and turboprop airplanes, released on the official CAA website.

Appendix 7 Hull loss and fatal incident rates in Taiwan's general aviation carriers

Year	Flight hour <sup>22</sup>	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate
	Hours	Occurrences	Per 10,000 flight hours	Occurrences	Per 10,000 flight hours
2012	4,335	1	2.31	1	2.31
2013	2,805	1	3.57	1	3.57
2014	2,797	0	0.00	0	0.00
2015	2,055	1	4.87	1	4.87
2016	2,623	0	0.00	0	0.00
2017	1,367	1	7.31	1	7.31
2018	5,477	0	0.00	0	0.00
2019	5,053	0	0.00	0	0.00
2020	3,511	0	0.00	0	0.00
2021	3,459	0	0.00	0	0.00
2012-2016	14,614	3	2.05	3	2.05
2013-2017	11,647	3	2.58	3	2.58
2014-2018	14,319	2	1.40	2	1.40
2015-2019	16,575	2	1.21	2	1.21
2016-2020	18,030	1	0.55	1	0.55
2017-2021	18,867	1	0.53	1	0.53

<sup>22</sup> Source: [Aviation safety statistics](#) for total flight hours, except for flight hours by helicopter passenger services, released on the official CAA website.

Appendix 8 Hull loss and fatal incident rates of helicopters

Year	Flight hour <sup>23</sup>	Departure <sup>20</sup>	Hull loss	Hull loss rate		Fatal incident	Fatal incident rate	
	Hours	Occurrences	Occurrences	Per 10,000 hours	Per 10,000 departures	Occurrences	Occurrences	Per 10,000 hours
2012	3,084	2,276	0	0.00	0.00	0	0.00	0.00
2013	2,090	1,842	1	4.78	5.43	1	4.78	5.43
2014	1,935	1,379	0	0.00	0.00	0	0.00	0.00
2015	1,317	1,134	1	7.59	8.82	1	7.59	8.82
2016	1,675	1,152	0	0.00	0.00	0	0.00	0.00
2017	1,587	1,463	1	6.30	6.84	1	6.30	6.84
2018	1,058	1,147	0	0.00	0.00	0	0.00	0.00
2019	1,347	979	0	0.00	0.00	0	0.00	0.00
2020	1,351	871	0	0.00	0.00	0	0.00	0.00
2021	1,102	781	0	0.00	0.00	0	0.00	0.00
2012-2016	10,101	7,783	2	1.98	2.57	2	1.98	2.57
2013-2017	8,604	6,970	3	3.49	4.30	3	3.49	4.30
2014-2018	7,572	6,275	2	2.64	3.19	2	2.64	3.19
2015-2019	6,984	5,875	2	2.86	3.40	2	2.86	3.40
2016-2020	7,018	5,612	1	1.42	1.78	1	1.42	1.78
2017-2021	6,445	5,241	1	1.55	1.91	1	1	1.91

<sup>23</sup> Source: [Aviation safety statistics](#) for national helicopter flight hours and departures, released on the official CAA website.

Appendix 9 Hull loss and fatal incident rates of public aircraft

Year	Flight hour	Departure	Hull loss	Hull loss rate		Fatal incident	Fatal incident rate	
	Hours	Occurrences	Occurrences	Per 10,000 flight hours	Per 10,000 Departures	Occurrences	Hours	Occurrences
2012	6,140.6	4,646	0	0.00	0.00	0	0.00	0.00
2013	6,579.9	4,814	0	0.00	0.00	0	0.00	0.00
2014	6,454.1	4,847	0	0.00	0.00	0	0.00	0.00
2015	6,302.7	4,895	0	0.00	0.00	0	0.00	0.00
2016	6,360.8	4,640	1	1.57	2.16	1	1.57	2.16
2017	7,260.6	4,719	0	0.00	0.00	0	0.00	0.00
2018	6,491.8	4,641	1	1.54	2.15	3	4.62	6.46
2019	6,181.8	4,417	0	0.00	0.00	0	0.00	0.00
2020	6,082.5	4,316	1	1.64	2.32	0	0.00	0.00
2021	7,098.8	4,975	0	0.00	0.00	0	0.00	0.00
2012-2016	31,838	23,842	1	0.31	0.42	1	0.31	0.42
2013-2017	32,958	23,915	1	0.30	0.42	1	0.30	0.42
2014-2018	32,870	23,742	2	0.61	0.84	4	1.22	1.68
2015-2019	32,598	23,312	2	0.61	0.86	4	1.23	1.72
2016-2020	32,378	22,733	3	0.93	1.32	4	1.24	1.76
2017-2021	33,116	23,068	2	0.60	0.87	3	0.91	1.30