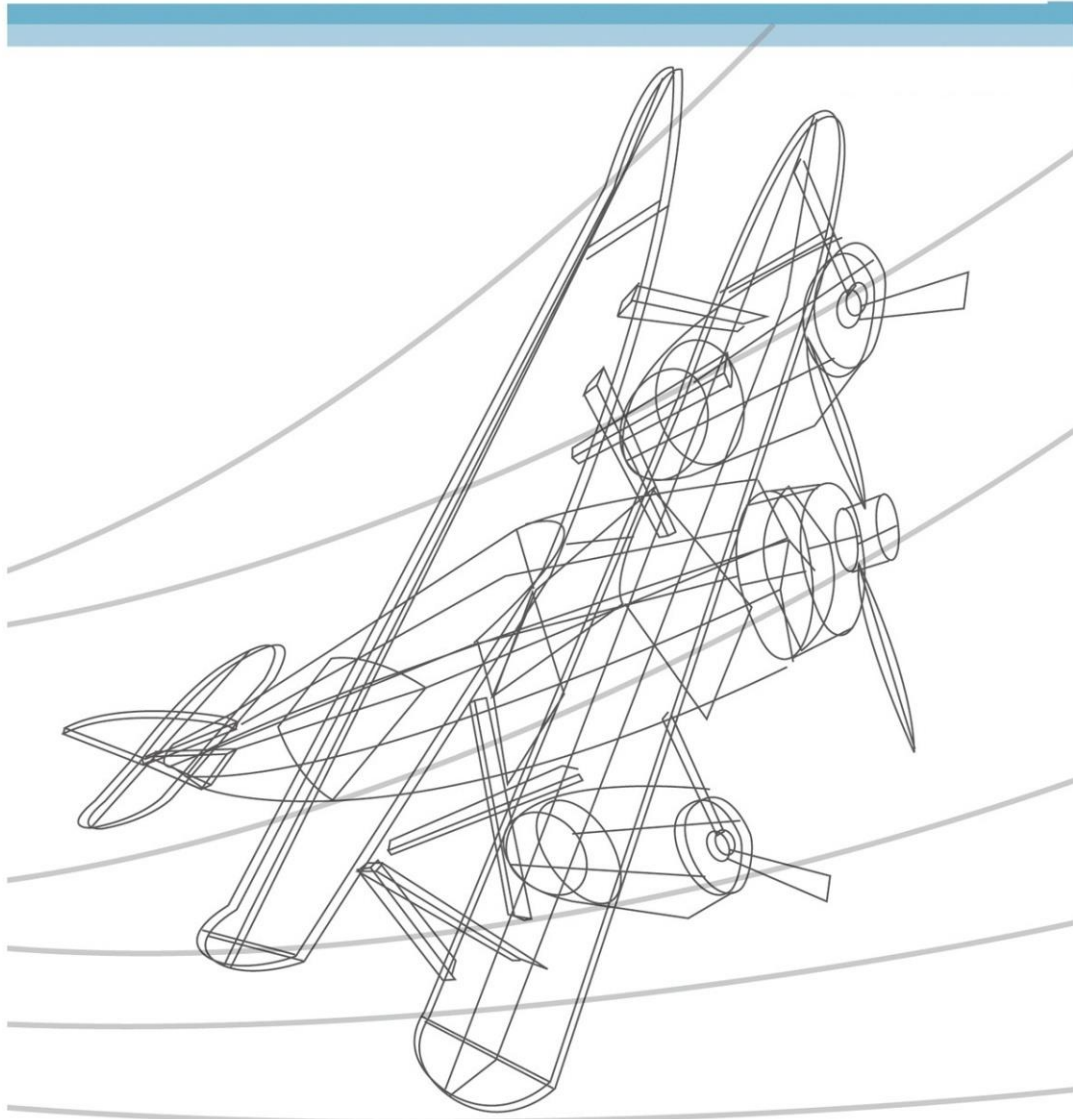


Taiwan Aviation Occurrence Statistics 2011-2020



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

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Abstract

2020 Aviation Occurrence Statistics

In 2020, national aircrafts were involved in four major aviation occurrences, one of which involved a civil air transport aircraft. This occurrence did not result in fatalities or hull loss, and therefore did not meet the International Civil Aviation Organization's (ICAO) criteria for an accident. As a result, the fatal occurrence rate, hull loss rate, and accident rate of civil air transport aircrafts for this year were all 0. One occurrence involved a public aircraft, resulting in hull loss but no fatalities. Two occurrences involved drones which included one vehicle experienced hull loss, and one vehicle was missing. Both of these two drone occurrences did not result in fatalities. In addition, no major aviation occurrences involving general aviation carriers, national helicopters, or ultra-light vehicles were reported in 2020.

Occurrence Statistics from 2011 to 2020

From 2011 to 2020, national aircrafts were involved in 83 major aviation occurrences. Civil air transport operations accounted for 48 occurrences, and followed by 12 ultra-light vehicle occurrences, 10 general aviation aircraft occurrences, 8 public aircraft occurrences, 2 flight trainer occurrences, 2 drone occurrences, and 1 free balloon occurrence. These occurrences resulted in a total of 117 fatalities.

Civil air transport turbojet airplanes in Taiwan have experienced no hull losses or fatalities over the past 10 years. Therefore, both of the 5-year moving average hull loss rate and fatal occurrence rate remained at 0, which were lower than 2016–2020 global turbojet hull loss and fatal accident rates (which were 0.21 and 0.12, respectively) from the International Air Transport Association (IATA).

Due to one occurrence involving civil air transport turboprop airplanes resulting in hull loss and fatalities in 2014 and 2015 respectively (TransAsia Airways GE222 and GE235), the 5-year moving average of hull loss rate of turboprop airplanes increased to 3.15 occurrences per million departures in 2014, and to 6.22 in 2015. The 2014 GE222 crash was no longer included in the moving average rate since 2019; therefore, the 5-year moving average for 2015–2019 hull loss rate dropped to 3.02; the same is true for fatal occurrence rate. Furthermore, the 2015 GE235 crash was no longer included in the moving average rate since 2020; therefore, both of the 5-year moving average for 2016–2020 total hull loss and fatal occurrence rates dropped to 0. Over the past 10 years, the IATA 5-year moving average global turboprop hull loss and fatal occurrence rates showed a downward trend; the 2016–2020 average hull loss rate was 0.98 and the fatal occurrence rate was 0.64.

Of the 48 major aviation occurrences involving national civil air transport aircraft

in the past decade, 9 meet the ICAO's definition of an accident. Among these 9 accidents, 5 accidents involved turbojets and resulted in 4 severe injuries; the other 4 accidents involved turboprops which included 2 accidents resulting in hull loss and a total of 91 fatalities and 24 people with severe injuries. In addition, according to the ICAO flight phase taxonomy, the highest number of 21 of these 48 major aviation occurrences happened in the landing phase, followed by 20 occurrences happened in the enroute phase. Furthermore, on a basis of the ICAO occurrence category 15 runway excursion occurrences were the highest number among all occurrence categories, followed by 12 occurrences involving system/component failure or malfunction (non-powerplant). Besides, according to the classification of occurrence causes by the US National Transportation Safety Board, most of these occurrences were "human-related" at 68.8%, followed by "environment-related" at 43.8% and "aircraft-related" at 35.4% respectively.

For national general aviation operations, there were 4 hull loss occurrences in the past 10 years and all resulted in fatalities. Both of the 5-year moving average of the hull loss and fatal occurrence rates showed a rising trend prior to 2017 and reached to 2.58 occurrences per 10,000 flights at its peak in 2017. Beginning from 2018, the moving average rate began to fall and reached to 0.55 occurrences per 10,000 flights in 2020.

National helicopters¹ were involved in 3 hull loss occurrences in the past 10 years and all of which resulted in fatalities. Both of the 5-year moving average for hull loss and fatal occurrence rates rose yearly prior to 2017, reaching to a peak of 3.49 occurrences per 10,000 flight hours, or 4.30 occurrences per 10,000 departures in 2017. After a decline in 2018, the 5-year moving average rose again in 2019 before dropping to 1.42 occurrences per 10,000 flight hours, or 1.78 occurrences per 10,000 departures in 2020.

National public aircraft were involved in 3 hull loss occurrences and 4 occurrences with fatalities in the past 10 years. Both of the 5-year moving average of hull loss and fatal occurrence rates were 0 in 2015, then began to rise in 2016. In 2020, the hull loss rate peaked at 0.93 occurrences per 10,000 flight hours, or 1.32 occurrences per 10,000 departures. The fatal occurrence rate began to rise gradually from 2016 and drastically rose in 2018. In 2020, the fatal occurrence rate peaked at 1.24 occurrences per 10,000 flight hours, or 1.76 occurrences per 10,000 departures.

National ultra-light vehicles were involved in 12 major aviation occurrences in the past 10 years. All 12 occurrences led to hull loss and 4 of them were fatal, resulting in a total of 5 deaths.

The Taiwan Transportation Safety Board (TTSB) began to investigate national

¹ It does not include public helicopters.

drone occurrences from April 2019. Up to the end of 2020, two major aviation occurrences involving drones had occurred; one vehicle experienced total hull loss, and the other was missing. Neither occurrence led to fatalities.

Safety Recommendations Statistics

From the establishment of the Aviation Safety Council (the organization before being restructured to the TTSB) in 1998 to the end of 2020, we have published 131 major aviation occurrences reports and proposed 1,069 recommendations to improve transportation safety. The greatest proportion of the recommendations was targeted at government-affiliated agencies at 52.6%, followed by aviation operators at 36.2% and international institutions at 11.2%. Of the 562 recommendations aimed at government-affiliated agencies, 97.5% have been implemented, and the remaining 2.5% (14 cases) are still being overseen by the Executive Yuan.

Introduction

The first section of this report summarizes the operations of national aircraft in 2020 and over the past 10 years (2011–2020). Topics include domestic airlines and the number of aircraft, civil air transport carriers, general aviation carriers, ultra-light vehicles, 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 analysis of aviation occurrences. The section first provides a basic introduction, which includes data sources, definitions, and classifications. The main content includes a summary of major aviation occurrences involving national aircraft in the past decade as well as statistics of major aviation occurrences involving national civil air transport carriers, national general aviation carriers, national helicopters, Taiwan’s public aircraft, ultra-light vehicles, and drones.

The third section tracks the progress of transportation safety recommendations and action plans. It includes the categorization of historical improvement suggestions, their statistics, the tracking of improvement suggestions and action plans, and the status of action plans that are “under supervision.”

This report is compiled using civil aviation jargon and statistics terms that are common among international organizations; relevant definitions and descriptions are provided in the appended glossary.

I. Operational Overview of National Aircraft²

1.1 Domestic Airlines and Number of Aircraft

Eight civil air transport carriers were in operation in Taiwan in 2011.³ Since then, domestic airlines have entered and exited the market. This includes 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 Communication revoked the air operator certificate of Far Eastern Air Transport. Up until the end of 2020, eight national civil air transport carriers were in operation, two of which⁴ provided helicopter transportation services.

Taiwan's general aviation companies increased from 7 in 2011 to 12 in 2020.⁵ Market changes included the establishment of Executive Aviation and Avanti Aviation in 2012, the launch of SkyRainbow Airlines and EVA Air's acquisition of a general aviation operating permit in 2014, the deregistration of SunRise Airlines' general aviation license as a civil aviation in 2017, and the addition of TDA Air in 2019. A new airline, Sky Vision, was launched in 2020.

Three airlines⁶ operate both civil air transport services and general aviation services; therefore, Taiwan has a total of 17 airlines. The fluctuating number of national airlines from 2011 to 2020 is illustrated in Figure 1; the operational overview indices over the past 10 years are presented in Appendix 1.

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

³ China Airlines, EVA Air, Uni Air, Mandarin Airlines, Tigerair Airlines, Starlux Airlines, Daily Air, and Emerald Pacific Airlines.

⁴ In addition to operating scheduled and nonscheduled transport service on domestic offshore and outlying air routes, Daily Air also operates scheduled and nonscheduled helicopter transport services on domestic routes; Emerald Pacific Airlines operates helicopter transport services on domestic routes.

⁵ Daily Air, Roc Aviation Company, Emerald Pacific Airlines, Great Wing Airline, Aerospace Industrial Development Corporation, Win Air, Executive Aviation, Avanti Aviation, EVA Air, SkyRainbow Airlines, TDA Air, and Sky Vision.

⁶ Daily Air, Emerald Pacific Airlines, and EVA Air.

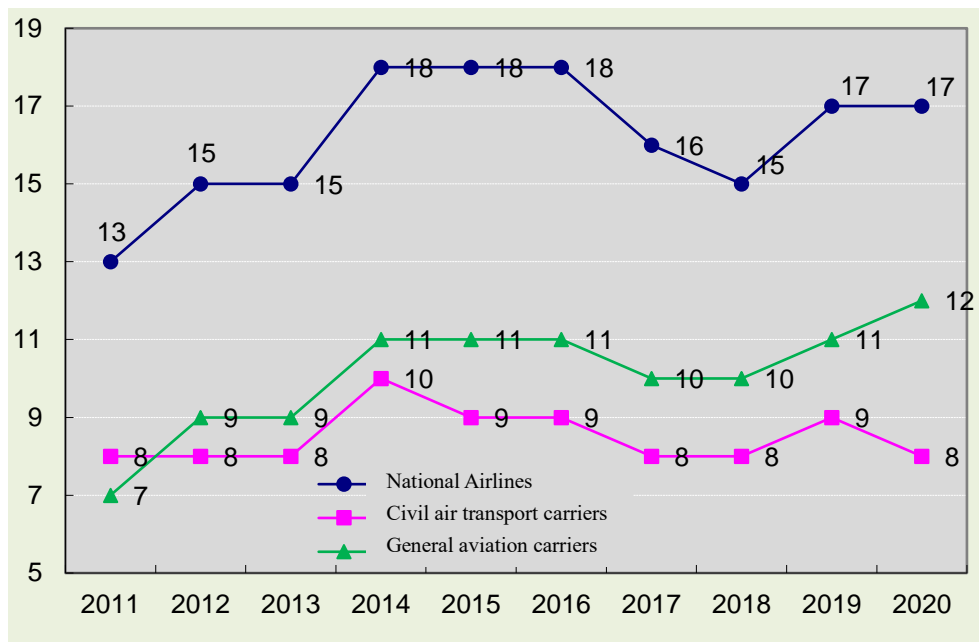


Figure 1 Civil air transport and general aviation carriers

Over the past 10 years, the number of aircraft registered in Taiwan⁷ has increased steadily mainly due to 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 199 in 2011 to a peak of 278 aircraft in 2019. In 2020, the number of airworthy aircraft decreased with the closure of Far Eastern Air Transport. The number of airworthy aircraft is depicted in Figure 2. As of 2020, Taiwan had 270 airworthy aircraft and 292 registered aircraft.

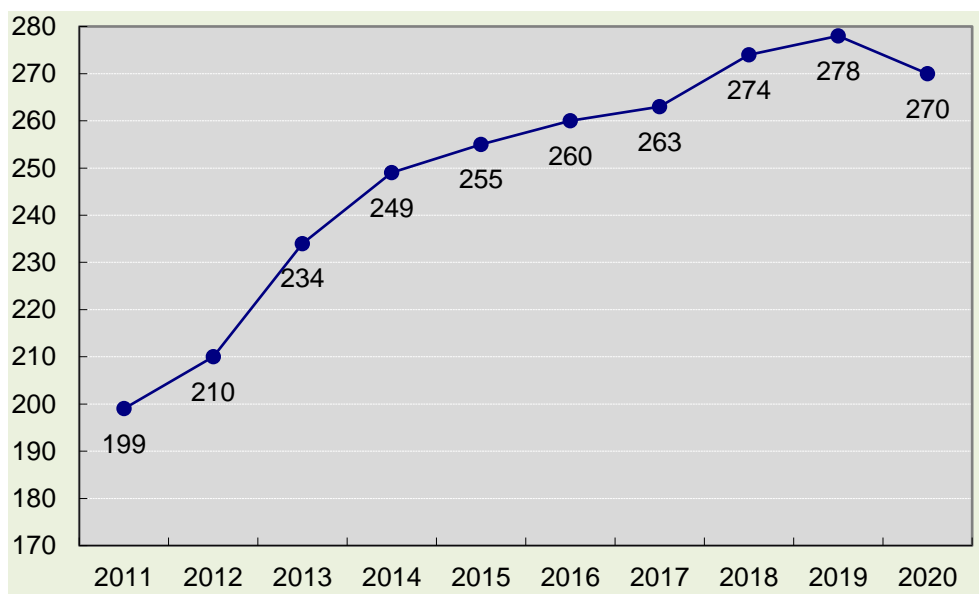


Figure 2 Number of airworthy aircraft in airline fleets

⁷ This number only includes aircraft owned by civil air transport and general aviation carriers and does not include public aircraft, ultra-light vehicles, or drones.

1.2 Civil Air Transport Carriers

Passenger Transportation

In 2020, impacted by the COVID-19 pandemic, civil air transport airlines in Taiwan carried approximately 10.22 million passengers, a 73.5% decrease from 2019. Approximately 5.19 million passengers traveled on international and cross-strait routes, accounting for 50.8% of passengers, an 84% decrease from 2019; 5.03 million passengers traveled on domestic routes, accounting for 49.2% of total passengers, a 17.7% decrease from 2019.

Figure 3 presents trends in civil air transport passengers in Taiwan from 2011 to 2020. Over the past 10 years, the overall number of passengers has increased from approximately 25.90 million in 2011 to a peak of approximately 38.52 million in 2019, before declining massively to 10.22 million passengers in 2020 as a result of the COVID-19 pandemic. International and cross-strait routes have increased yearly from approximately 20.71 million passengers in 2011 to a peak of 32.41 million passengers in 2019, then declined to 10.22 million passengers. Domestic routes had 5.19 million passengers in 2011. After a slight decline and recovery in 2015, they rose to a peak of 6.11 million passengers in 2019 before dropping to 5.03 million passengers in 2020.

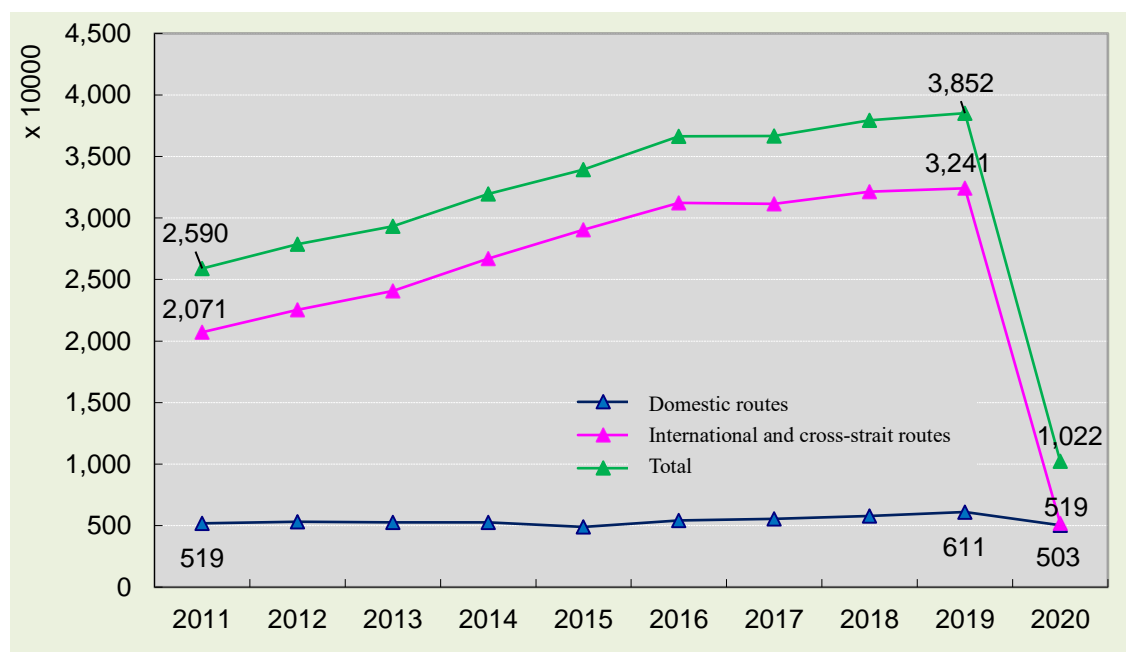


Figure 3 Civil air transport passengers

Freight

In 2020, civil air transport carriers in Taiwan transported approximately 2.306 million tons of air cargo, an 11.3% increase from the previous year. Approximately 2.264 million tons of air cargo were transported on international and cross-strait routes, far surpassing air cargo on domestic routes and accounting for 98.2% of the total air cargo, an 11.6% increase from the previous year. Approximately 42,000 tons of air cargo were carried on domestic routes, accounting for 1.8% of total air cargo and a 2.2% decrease from 2019.

Figure 4 presents the trends in air freight carried by national civil air transport companies from 2011 to 2020. The overall cargo load increased from approximately 1.78 million tons in 2011 to a peak of approximately 2.306 million tons in 2020 after a considerable increase in 2017; the 10-year growth rate was 29.5%. International and cross-strait routes transported approximately 1.728 million tons of cargo in 2011. After a substantial growth in 2017, an all-time high of 2.264 million tons of air freight was transported in 2020. The 10-year growth rate was 31%. After transporting 51,000 tons of cargo in 2010, domestic routes exhibited an 18.3% decline in total cargo tonnage over the past 10 years.

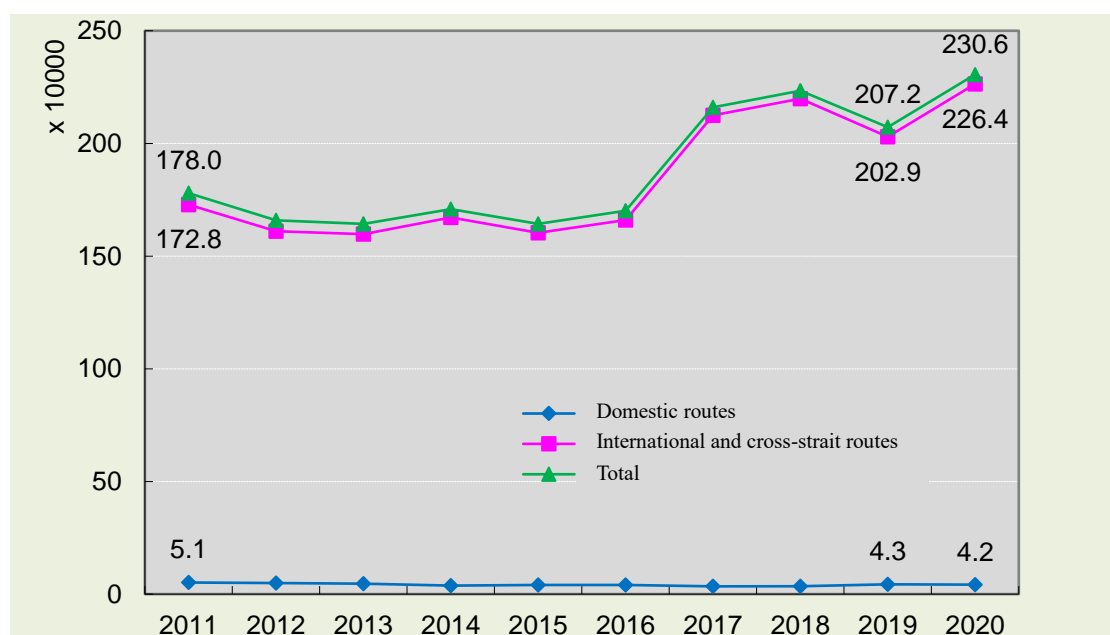


Figure 4 Air freight by national civil air transport carriers

Number of Flights

Due to the effects of the COVID-19 pandemic, civil air transport carriers in Taiwan operated a total of approximately 165,800 flights in 2020, a 39.5% decrease from 2019. Approximately 86,100 of these flights were on international and cross-strait routes, accounting for 51.9% of all flights, a 50.7% decrease from 2019. Approximately 79,700 flights were operated on domestic routes, accounting for 48.1% of all flights, a 19.4% decrease from 2019.

Figure 5 depicts the trends in flights operated by civil air transport carriers from 2011 to 2020. The total number of flights increased steadily from approximately 209,700 flights in 2011 to a peak of 273,600 flights in 2019, despite a decline in 2017, before a massive decline to approximately 165,800 flights in 2020 as a result of the global pandemic. The number of flights on international and cross-strait routes rose from 122,000 flights in 2011 to a peak of 178,800 flights in 2016, then dropped to 86,100 flights in 2020. In 2011, approximately 87,700 flights operated on domestic routes, which demonstrated an overall moderate upward trend, peaking at 98,900 flights in 2019 and then dropping to 79,700 flights in 2020.

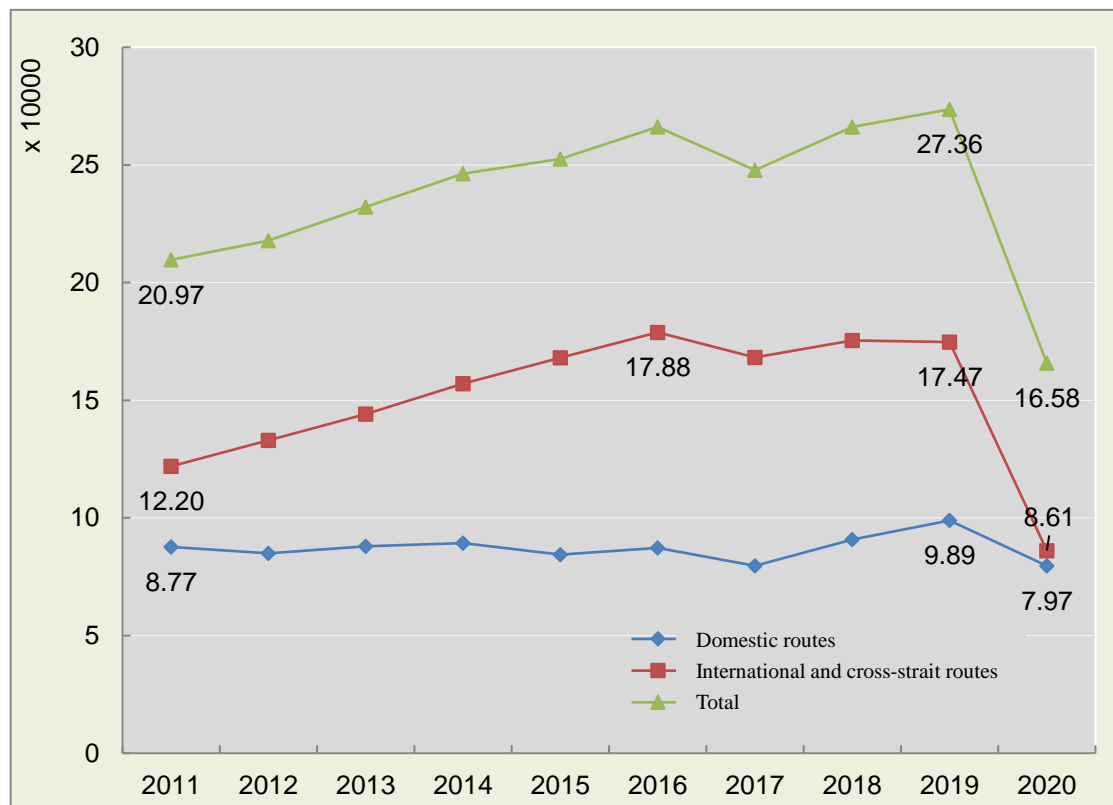


Figure 5 Flights by civil air transport carriers

1.3 General Aviation Carriers

General aviation carriers in Taiwan logged a total of 3,510.7 flight hours in 2020, a 30.5% reduction compared with 2019. The trends in flight hours among general aviation carriers in Taiwan from 2011 to 2020 is presented in Figure 6;⁸ over the past 10 years, the number of flight hours of general aviation carriers exhibited a general downward trend, followed by a sharp increase to a maximum of 5,476.7 hours in 2018 and a modest decline over the following 2 years; the 10-year decline rate was 25.7%.



Figure 6 Flight hours logged by general aviation carriers

1.4 Ultra-Light Vehicles

The Ministry of Transportation and Communications amended the Civil Aviation Act in 2003 to include articles on ultra-light vehicles. The next year, the Regulations on Ultra-Light Vehicles were promulgated, officially incorporating ultra-light vehicles into the ministry's oversight.

As of the end of 2020, the Civil Aeronautics Administration (CAA) had announced 22 airspaces for ultra-light vehicles, 10 approved active airspaces, 5 airfields available for legal flying activities,⁹ and 7 groups that can legally engage in flying activities with ultra-light vehicles.¹⁰ Sixty-five ultra-light vehicles passed inspection.

⁸ The general aviation carrier flight hours reported in the 2017 CAA Civil Aviation Statistics only listed flight hours by Daily Air and Emerald Pacific Airlines and no other general aviation carriers.

⁹ These spaces are Wuri, Taichung City; Jiho, Pingtung County; Huatong, Hualien; Matai'an, Hualien County; and Wang'an, Penghu County.

¹⁰ These are the Chinese Taipei Aviation League, Chinese Taipei Powered Paragliding Association,

1.5 Drones

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

The TTSB amended the Transportation Occurrences Investigation Act on April 24, 2019, to incorporate national drones into its scope of investigation. Occurrences that shall be reported by the owner or operator of the drone to the 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 2020, 62,442 drones had been registered with the CAA.

1.6 Flight Training Institutions

Apex Flight Academy was established on September 24, 2014, and is Taiwan's first flight academy to have passed the CAA's five-stage review process. Apex's flight operations and maintenance base and training facilities are located at the Taitung Fongnien Airport and include academic and technical training facilities. 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 2020, Apex Flight Academy had eight registered aircraft, all of which were airworthy.

1.7 Free Balloons

Free balloons (including free air balloons and hot air balloons) refer to 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 practice, 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 2020, 19 free balloons had received certificates of registration in Taiwan, 10 of which were airworthy.

1.8 Public Aircraft

In the past, because of different mission requirements, the 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

Hualien Aeronautic Association, Hualien Ultra-light Sports Association, KaiXiang Aerosports Association, Taiwan Taiya Aeronautical Tourism and Development Association, and Taiwan Recreational Aviation Association.

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 2020, the NASC had 24 aircraft: 23 helicopters and 1 fixed-wing aircraft. The number of flights and flight hours made by the NASC over the past 10 years, based on statistics provided by the NASC (Appendix 2), is illustrated in Figure 7; both numbers have trended downwards by 3.2% and 10%, respectively, over the past 10 years.

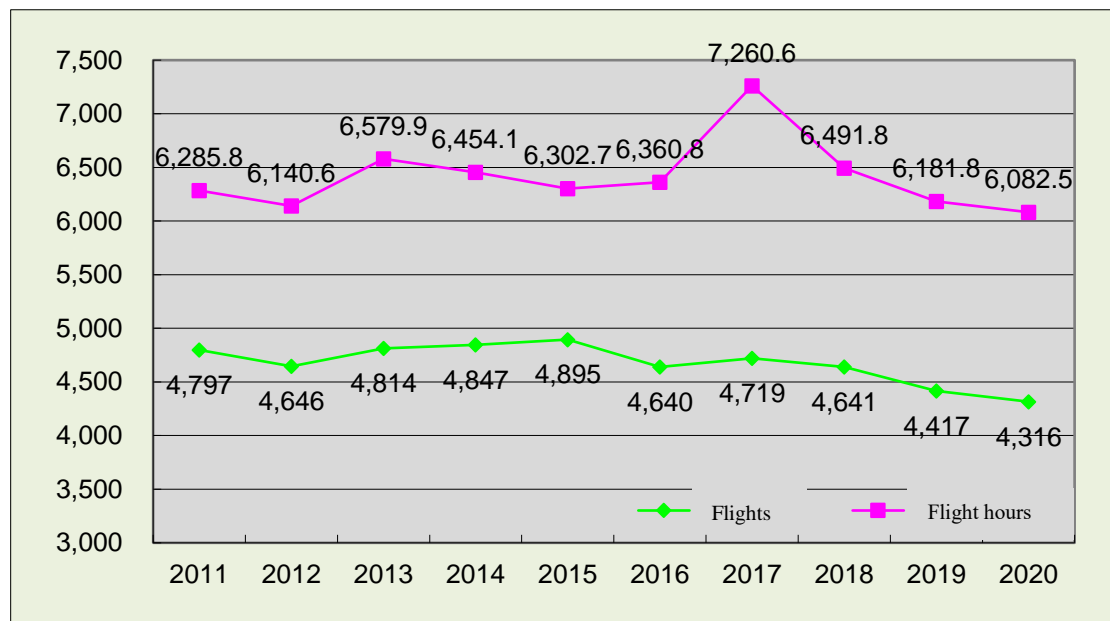


Figure 7 Number of flights and flight hours logged by NASC aircraft

II. Statistical Analysis of Major aviation occurrences

2.1 Basic Description

Data Source

The data in this section are derived from the TTSB's investigation reports on major aviation occurrences, statistics on aviation safety reported by the CAA, statistics compiled by the NASC, annual safety reports released by the IATA, and the annual safety reports published by the ICAO.

Definitions and Classifications

The aviation terminology used in this report is defined with reference to the Civil Aviation Act, Aircraft Flight Operation Regulations, 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 appendix).

To facilitate comparisons with international occurrence statistics, statistical analyses on civil air transport occurrences were performed according to the classification methods of the IATA,¹¹ ICAO, and US National Transportation Safety Board (NTSB).

- IATA guidelines were used to calculate the hull loss and casualty rates of civil air transportation turbojet and turboprop aircraft with maximum takeoff weights of 5,700 kg or more, using per million departures over 5 consecutive years¹² as the statistical basis.
- ICAO definitions of accidents, flight phases, and occurrence taxonomy were employed in the classification and statistics of Taiwan's major aviation occurrences in the past 10 years.
- The NTSB's classification of accident factors was used in the classification and statistics of Taiwan's major aviation occurrences over the past 10 years.

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

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

¹¹ Data on incident rates released by the CAA use the same categories as the IATA and a 5-year moving average to calculate the hull loss rate of civil air transport turbojet and turboprop airplanes with maximum take-off weights of 5,700 kg or more.

¹² Since 2015, IATA only provides data on global departures and no data on flight times.

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

Table 1 Civil air transport turbojet airplane models

AIRBUS	BOEING	EMBRAER
A320	737	ERJ-190
A321	747	
A330	777	
A350	787	
	MD-80	

Table 2 Civil air transport turboprop airplane models

ATR	DE HAVILLAND (BOMBARDIER)
ATR72	DHC-6

Table 3 General aviation aircraft models

Airplanes		Helicopters
A318	EMB-505	AW169
A319	G280	BELL-206
ASTRA-SPX	G550	BK-117B
BD-700	G650	
BN-2	HAWKER 400	
DA-40NG	P68C	
DA-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 2020, none of which resulted in fatalities. One occurrence involved a civil air transport carrier. One occurrence involved a public aircraft and resulted in total hull loss. Two occurrences involved drones: one vehicle experienced total hull loss, and the other vehicle is missing. The statistics are presented in Table 6.

Table 6 Major aviation occurrences in 2020

Category	Aviation occurrences			Fatalities	
	Total case	Fatal occurrence	Hull loss	Total people	People on board
National civil air transport turbojet aircrafts	1	0	0	0	0
National civil air transport turboprop aircrafts	0	0	0	0	0
National civil air transport aircrafts (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
Ultra-light vehicles	0	0	0	0	0
Public aircraft	1	0	1	0	0
Drones	2	0	2	0	0
Total	4	0	3	0	0

From 2011 to 2020, national aircraft were involved in 83 occurrences. Aircraft in the civil aviation category accounted for 48 occurrences (the majority), followed by 12 ultra-light vehicle occurrences, 10 general aviation occurrences, 8 public aircraft occurrences, 2 flight trainer occurrences, 2 drone occurrences, and 1 free balloon occurrence. These occurrences resulted in 117 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 past 10 years

Category	Major flight occurrences			Fatalities	
	Total case	Fatal occurrence	Hull loss	Total cases	Fatalities
National civil air transport turbojet aircrafts	36	0	0	0	0
National civil air transport turboprop aircrafts	12	2	2	91	91
National civil air transport aircrafts (total)	48	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
Ultra-light vehicles	12	4	12	5	5
Public aircraft	8	4	3	10	10
Drones	2	0	2	0	0
Total	83	14	24	117	117

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 compare civil air transport occurrence rates with global data from the IATA.

Turbojet airplanes in Taiwan's civil air transport carriers have not been involved in any hull loss occurrences in the past 10 years. As a result, the 5-year moving average for hull losses has remained at 0. IATA's 5-year moving average of the global turbojet airplane hull loss rate has exhibited a downward trend, continuing to drop from 0.35 occurrences per million departures in the 2011–2015 period to 0.21 occurrences per million departures in the 2016–2020 period (Figure 8). Please see Appendix 4 for detailed statistics.

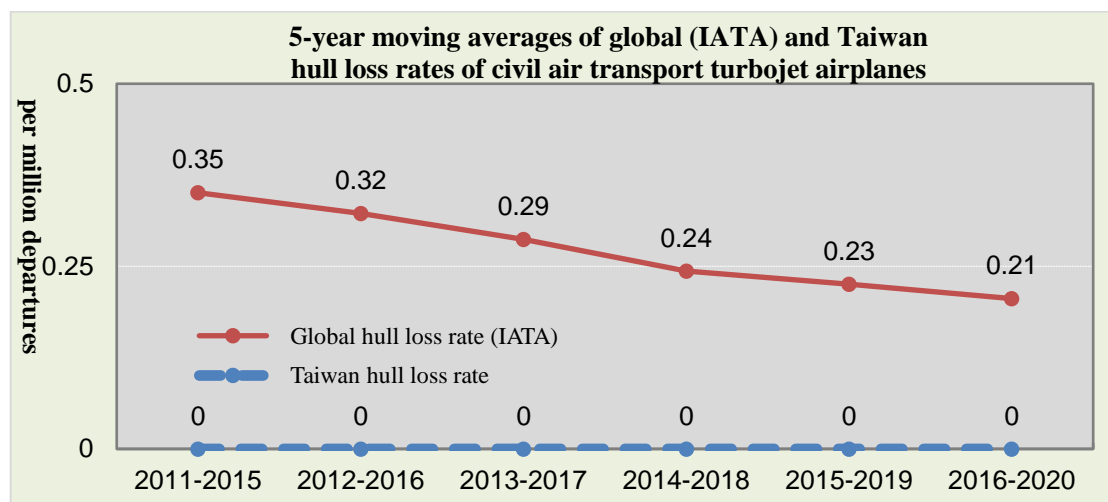


Figure 8 Global (IATA) and Taiwan hull loss rates of civil air transport turbojet aircrafts

Five-year Moving Averages of the Fatal Occurrence Rate

Civil air transport turbojet airplanes in Taiwan were not involved in any fatalities within the past 10 years; therefore, the 5-year moving average has remained at 0. IATA's 5-year moving average of the global rate of fatalities involving turbojet airplanes has exhibited an overall downward trend, decreasing from 0.16 occurrences per million departures in the 2011–2015 period to 0.09 occurrences per million departures in the 2013–2017 period, then rising again to 0.12 occurrences per million departures in the 2016–2020 period (Figure 9). Please refer to Appendix 4 for detailed statistics.

The statistics demonstrate that turbojet airplanes have higher hull loss rates than fatal occurrence rates. This is because some cases resulted in hull loss but not in fatalities.

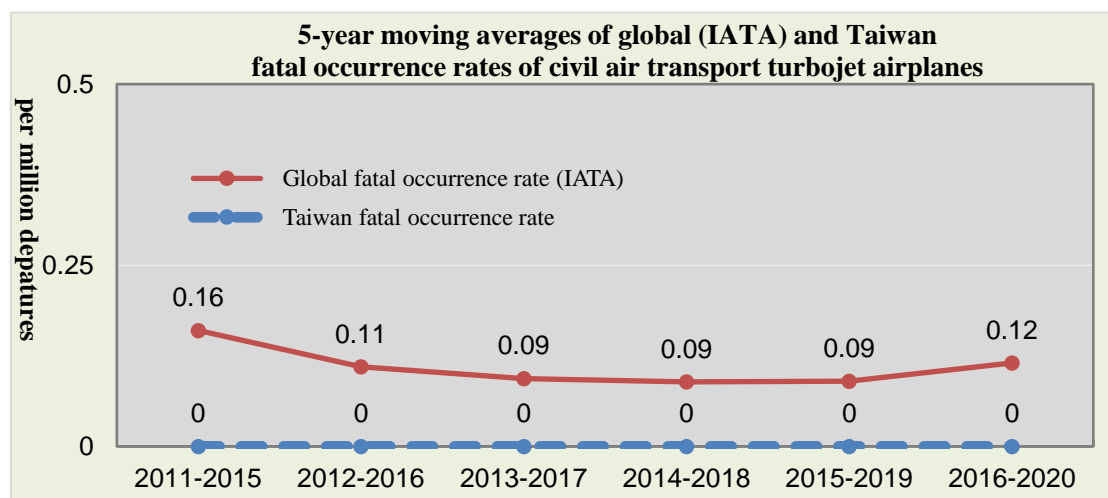


Figure 9 Global (IATA) and Taiwan fatal occurrence rates of civil air transport turbojet aircrafts

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 the hull loss occurrence rate for civil air transport turboprop airplanes for the 2011–2015 period in Taiwan rose to 6.22 occurrences per million departures. The moving average then remained in the range of 6.18–6.33 occurrences per million departures for the subsequent 3 years.

As of 2019, the crash of TransAsia flight GE222 in 2014 is no longer included in the moving average; therefore, the 5-year moving average for 2015–2019 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 of hull loss occurrences dropped to 0.

The 5-year moving average of IATA’s global turboprop hull loss occurrence rates has trended downward, dropping from 2.51 occurrences per million departures in the 2011–2015 period to 0.98 occurrences per million departures in the 2015–2019 period. This average was maintained for the 2016–2020 period (Figure 10). Detailed statistics are presented in Appendix 5.

According to the IATA, turboprop airplanes experienced 4.7 times the hull loss occurrence rate of turbojet airplanes during the 2016–2020 period

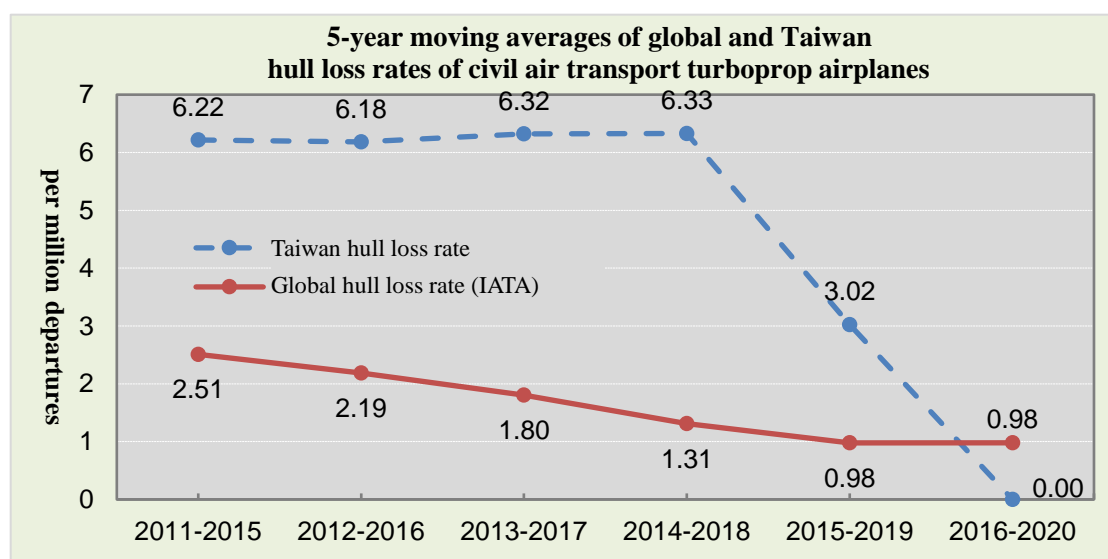


Figure 10 Global (IATA) and Taiwan hull loss rates of civil air transport turboprop aircrafts

Five-year Moving Averages of the Fatal Occurrence Rate

Following occurrences in 2014 and 2015 that resulted in fatalities (TransAsia flights GE222 and GE235), the 2011–2015 5-year moving average of the fatal occurrence rate for civil air transport turboprop airplanes in Taiwan increased to 6.22 occurrences per million departures. The moving average then remained in the range of 6.18–6.33 occurrences per million departures for the subsequent 3 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 of fatalities 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 fatalities dropped to 0.

The 5-year moving average of IATA’s global turboprop fatal occurrence rate has trended downward, dropping from 1.32 occurrences per million departures in the 2011–2015 period to 0.64 occurrences per million departures in the 2015–2019 period. This average was maintained in the 2016–2020 period (Figure 11). The detailed statistics are presented in Appendix 5.

According to the IATA, turboprop airplanes demonstrated 5.3 times the fatal occurrence rate of turbojet airplanes during the 2016–2020 period.

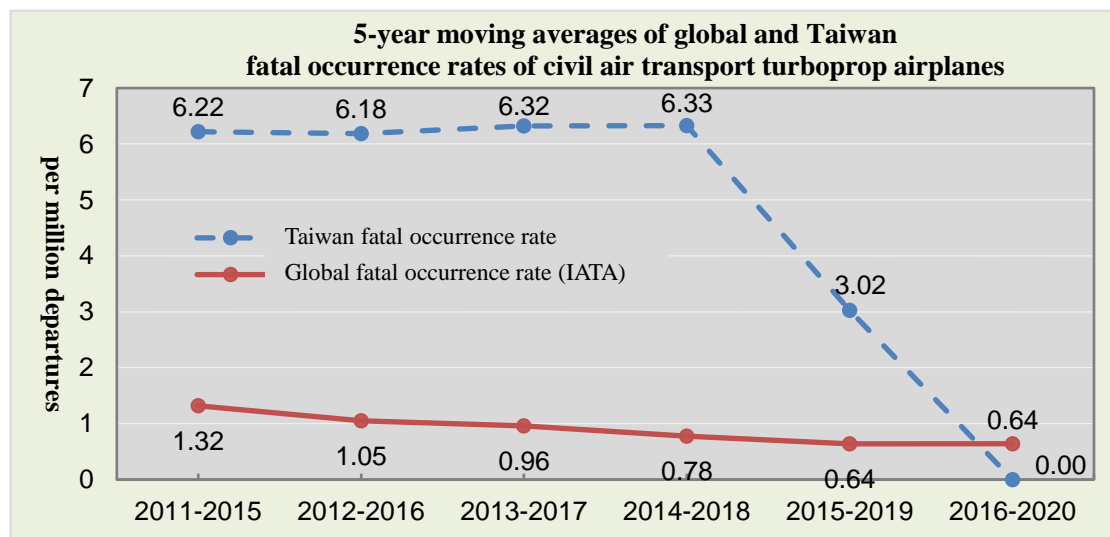


Figure 11 Global (IATA) and Taiwan fatal occurrence rates of civil air transport turboprop aircrafts

2.3.3 Annual Airplane Accident Rates

According to the ICAO's definition of an accident (see appendix),¹³ nine of the major aviation occurrences involving civil aviation aircraft in the 2011–2020 period¹⁴ are considered accidents (Table 8). Five of the accidents involved turbojet airplanes, resulting in four people with severe injuries. Four of the accidents involved turboprop airplanes, two of which resulted in hull loss and a total of 91 fatalities and 24 people with severe injuries.

Table 8 Civil air transport accidents involving national aircraft over the past 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 in 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	Japan-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 east coast of Kyushu, Japan	Enroute	None	0	2

Figure 12 illustrates the number of accidents involving national civil air transport aircrafts, the rate of occurrences per million departures, and the ICAO global civil

¹³ The ICAO only includes fixed commercial flights for profit (including passenger, cargo, and mail services) by fixed-wing aircraft with maximum take-off weights of 5,700 kg or more in their calculation of the accident rate in the civil aviation carriers.

¹⁴ Includes incidents involving national aircraft that occurred and were investigated overseas, except for one incident that happened during a training flight.

aviation accident rate from 2011 to 2020.¹⁵ Please refer to Appendix 6 for more details. Accidents resulting in substantial hull loss or passenger injuries took place twice in 2012 and thrice in 2017, causing the occurrence rate of Taiwan’s civil air transport aircrafts to be higher than the ICAO global average.

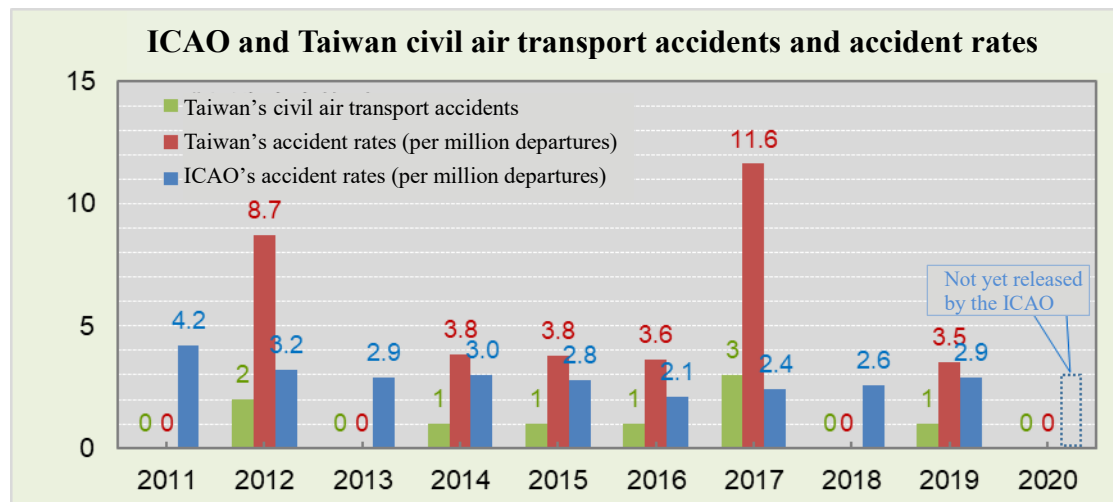


Figure 12 ICAO and Taiwan statistics on civil air transport accidents

2.3.4 Classification of Occurrences by Flight Phases

According to the flight phases defined by the ICAO, of the 48 major civil air transport occurrences in the past 10 years, 21 occurrences happened during the landing phase (the largest proportion); these occurrences involved runway excursions, tail strikes, or hard landings. Twenty occurrences involving abnormal cabin pressure, smoke, turbulence, or engine malfunction took place during the enroute phase. The number of occurrences by flight phase is depicted in Figure 13.

¹⁵ As of the submission deadline of this report, the ICAO had not completed its calculation of the 2020 global accident incident rate.

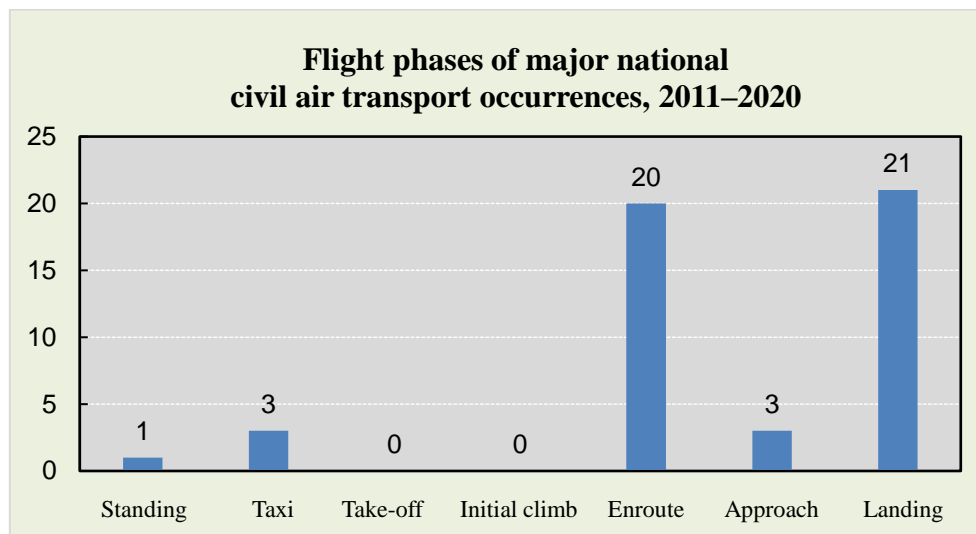


Figure 13 Flight phases of major civil air transport occurrences

2.3.5 Occurrence Categories

The ICAO's occurrence categories are listed in the appendix. Depending on its nature, an occurrence may fit more than one category; for instance, an engine fire may simultaneously be categorized as a system/component failure or malfunction (powerplant) and fire/smoke (non-impact). Aircraft crashes resulting from loss of control can be categorized as both system/component failure or malfunction (non-powerplant) and loss of control (inflight).

The categories of the 48 major civil air transport occurrences are presented in Figure 14. The statistical results indicate that from 2011 to 2020, runway excursions had the highest occurrence rate at 15 occurrences, followed by 12 occurrences involving system/component failure or malfunction (non-powerplant).

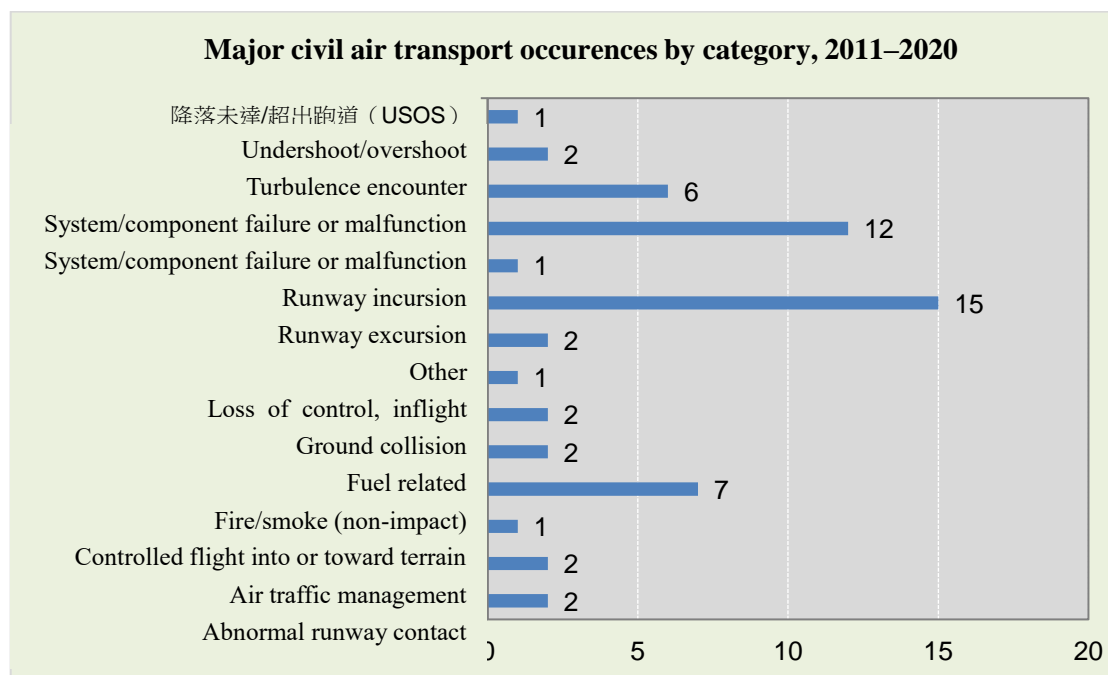


Figure 14 Major civil air transport occurrences by category

2.3.6 Occurrence Causes and Factors

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

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

The statistical results (Figure 15) indicate that the highest percentage of causes and factors in major civil air transport occurrences over the past 10 years were human-related, at 68.8% with 33 cases (56.3% pilot-related and 12.5% related to maintenance workers, ground crew, cabin crew, ATC, or other personnel). Environment-related factors were involved in 21 cases, accounting for 43.8% of all occurrences (31.3% related to the weather and 12.5% related to airport/ATC/navigation facilities). Aircraft-related causes and factors were present in 17 cases, accounting for 35.4% of all cases (25% system and equipment-related, 8.3% engine-related, and 2.1% structure-related).

Other factors were involved in two cases, accounting for 4.2%.

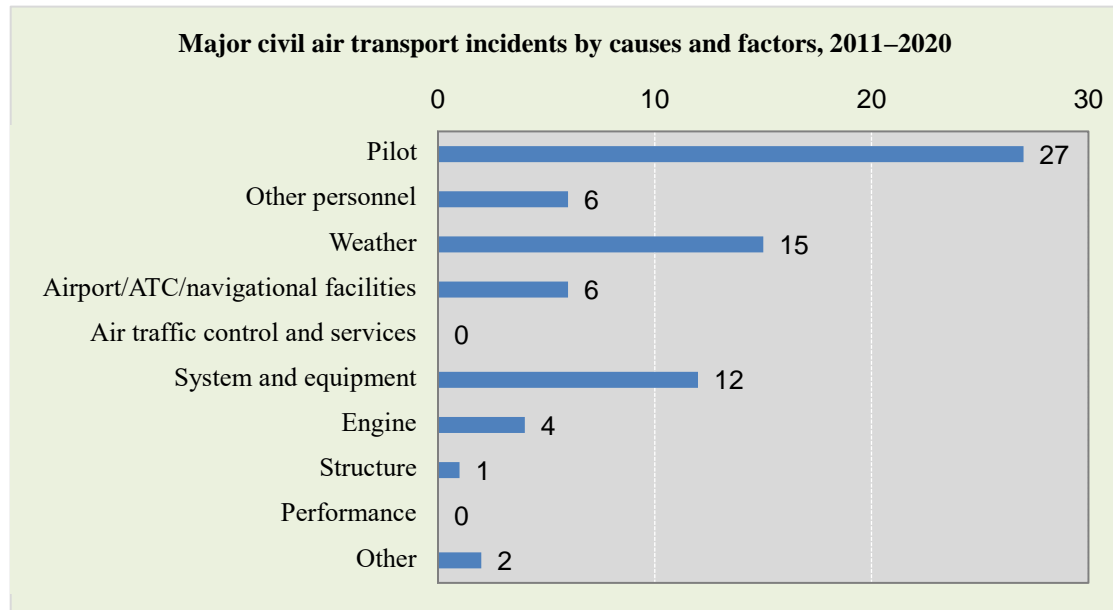


Figure 15 Major civil air transport occurrences by causes and factors

2.4 Major Aviation Occurrences in the General Aviation Carriers

Five-year Moving Averages of the Hull Loss and Fatal Occurrence Rates

In 2020, no major aviation occurrence was reported in Taiwan's general aviation carriers. In the past 10 years, four occurrences of hull loss happened: 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 in 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 continued to decline, and as of 2020, the 5-year moving average of the hull loss and fatal occurrence rates had dropped to 0.55 occurrences per 10,000 flight hours (Figure 16). The details are presented in Appendix 7.

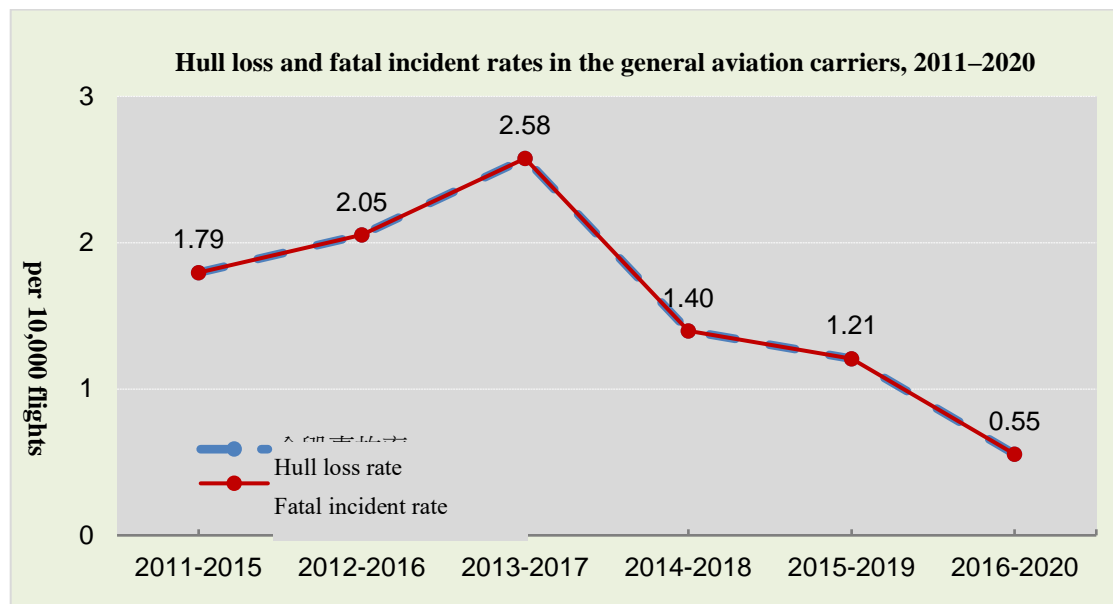


Figure 16 Hull loss and fatal occurrence rates in the general aviation carriers

2.5 Major Occurrences Involving Helicopters

Five-year Moving Averages of the Hull Loss and Fatal Occurrence Rates

Taiwan’s helicopters were not involved in any major aviation occurrence in 2020. In the past 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. In 2020, the moving average dropped again to 1.42 occurrences per 10,000 flight hours, or 1.78 occurrences per 10,000 departures (Figure 17). The details are presented in Appendix 8.

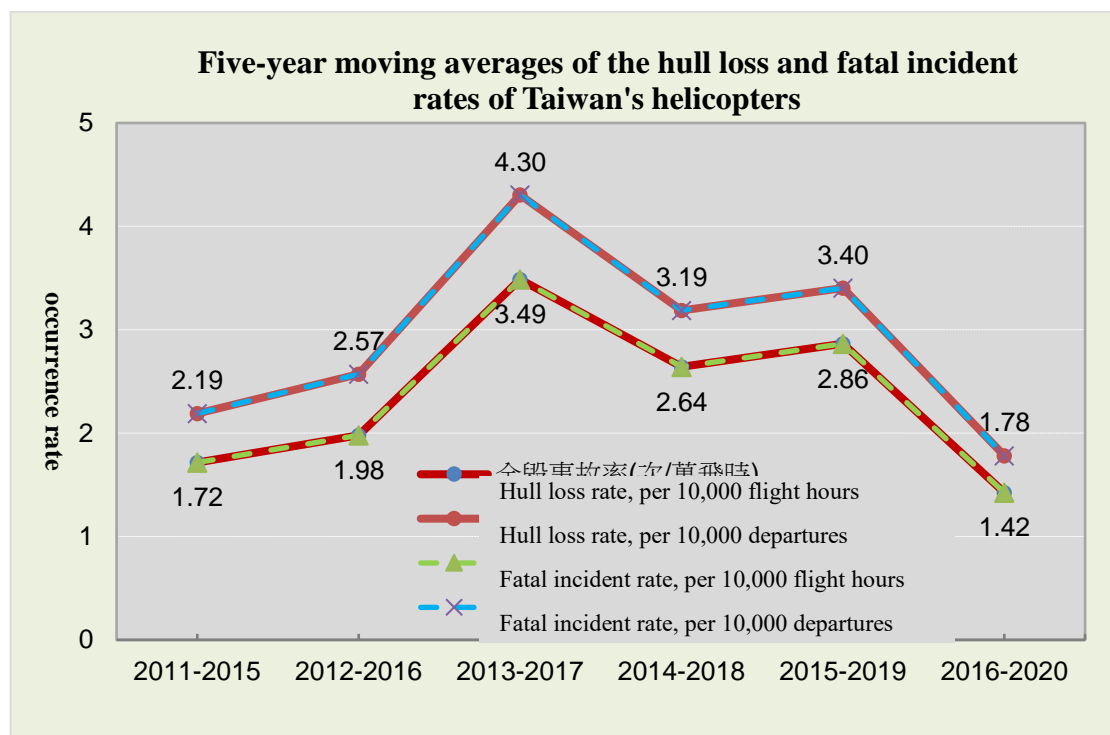


Figure 17 Hull loss and fatal occurrence rates of Taiwan's helicopters

2.6 Major Occurrences Involving Public Aircraft

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

Five-year Moving Averages of the Hull Loss Rate

The 5-year moving average of the hull loss rate of Taiwan public aircraft for 2011–2015 was 0. Since 2016, the moving average has exhibited an upward trend, reaching a peak of 0.93 occurrences per 10,000 flight hours or 1.32 occurrences per 10,000 departures in 2019 (Figure 18). The details are presented in Appendix 19.

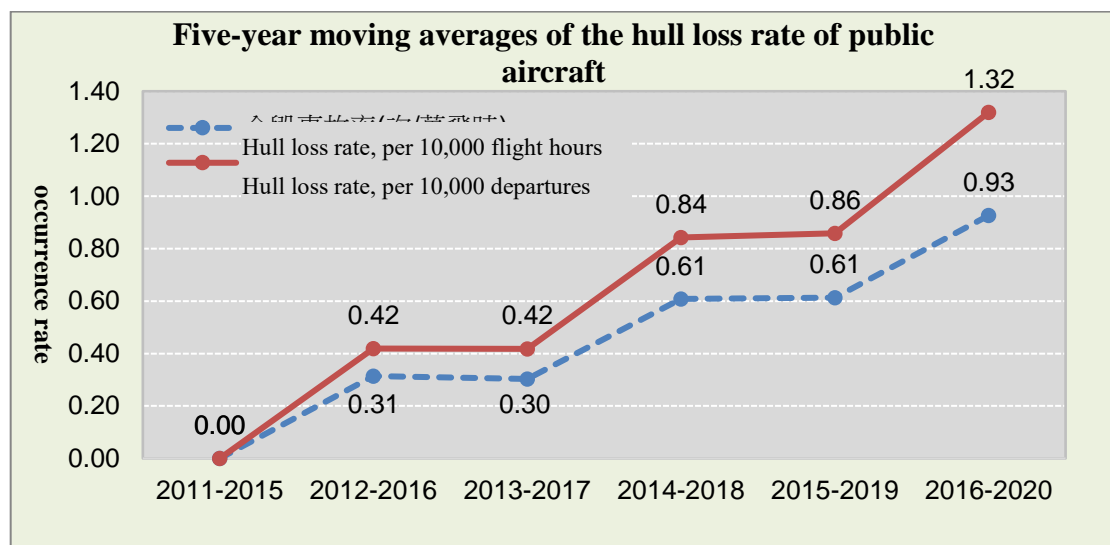


Figure 18 Hull loss rates of public aircraft

Five-year Moving Averages of the Fatal Occurrence Rate

The 5-year moving average of the fatal occurrence rate of Taiwan public aircraft for 2011–2015 was 0. Since 2016, the moving average has exhibited an upward trend and increased substantially since 2018 to reach a peak of 1.24 occurrences per 10,000 flight hours or 1.76 occurrences per 10,000 departures in 2020 (Figure 19). The details are presented in Appendix 9.

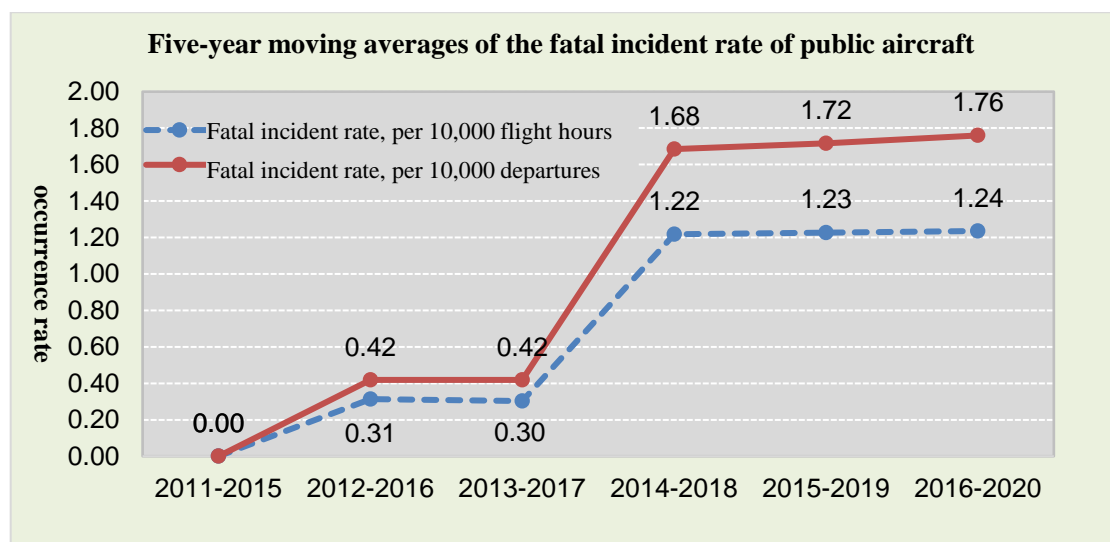


Figure 19 Fatal occurrence rates of public aircraft

2.7 Major Occurrences Involving Ultra-Light Vehicles

In 2004, ultra-light vehicles were formally included in the Civil Aviation Act, and major occurrences involving these aircraft were incorporated into the investigative jurisdiction of the TTSB.

Ultra-light vehicles were not involved in any occurrences of hull loss in 2020. Over the past 10 years, 12 major aviation occurrences were reported; each occurrence

involved total hull loss, and four occurrences were fatal, resulting in five deaths (Figure 20). The details are presented in Appendix 3.

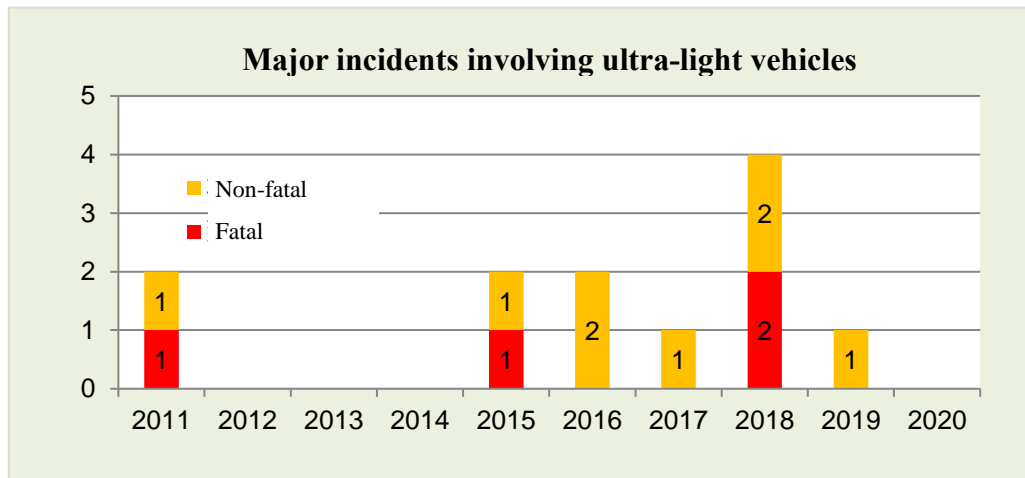


Figure 20 Major occurrences involving ultra-light vehicles

2.8 Major Occurrences Involving Drones

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

Drones were involved in two major aviation occurrences from their incorporation into the investigative jurisdiction of the TTSB (April 2019) to the end of 2020. One vehicle experienced total hull loss, and the other vehicle was missing. No persons were injured in either occurrence. The details are presented in Appendix 3.

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 discover their causes and provide appropriate recommendations to prevent similar future occurrences. Since the establishment of our predecessor, the Aviation Safety Council (1998), as of the end of 2020, TTSB have investigated 131 major aviation occurrences, and in our reports, we provided 1,069 recommendations to improve transportation safety.

Government-affiliated agencies received the greatest proportion of the recommendations (562 items; approximately 52.6%), followed by aviation businesses (387 items; approximately 36.2%). International institutions received the fewest recommendations (120 items; approximately 11.2%).

In terms of operational categories, civil air transport carriers received the highest proportion of recommendations (646 items; approximately 60.5%), followed by general aviation carriers (217 items; approximately 20.3%), public aircraft (135 items; 12.6%), ultra-light vehicles (67 items; 6.2%), and drones (4 items; 0.4%), 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	299	238	109	646	60.4%
General aviation	102	110	5	217	20.3%
Public aircraft	123	8	4	135	12.6%
Ultra-light vehicles	38	27	2	67	6.2%
Drones	0	4	0	4	0.4%
Total	562	387	120	1,069	100%
Percentage	52.6%	36.2%	11.2%	100%	

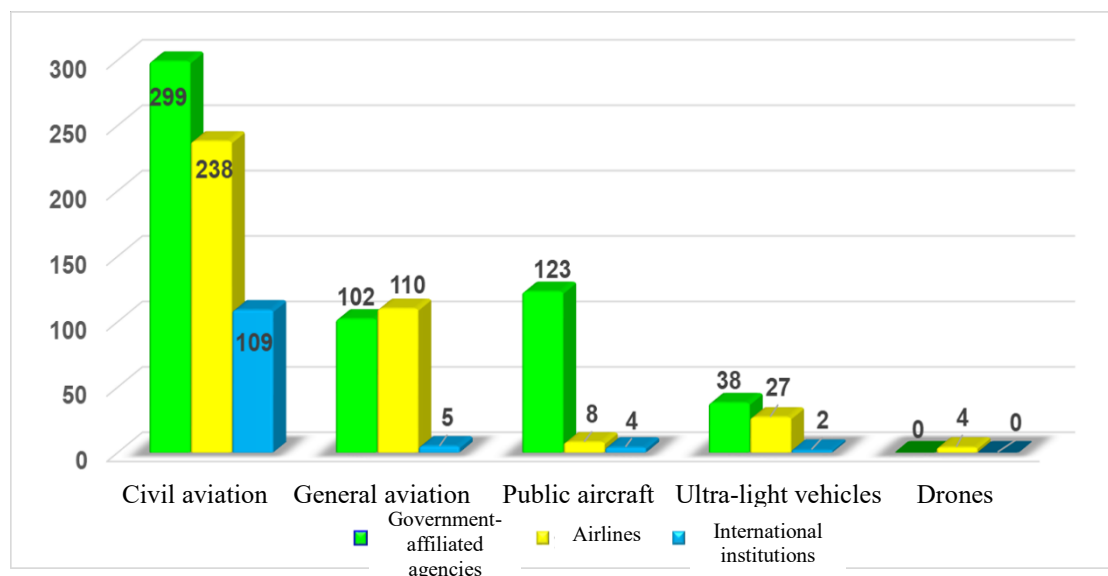


Figure 21 Historical transportation safety recommendations by type

3.2 Implementation Progress of Actions Plans to Enact the 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 the action plans according to their implementation status. The TTSB would suggest that the Executive Yuan accept action plans with concrete and actionable tasks that have been completed and close the case. For action plans that fail to achieve the improvement targets, the TTSB would suggest the Executive Yuan reject these plans, and the affiliated agencies be asked to resubmit a plan or supplemental information. If the action plan has a longer schedule or must be completed in stages, the TTSB would suggest the plan be overseen by the Executive Yuan and its status tracked every 6 months until the improvements are completed and the case can be closed.

As of the end of 2020, 14 of the 562 aviation safety recommendations remain under the Executive Yuan’s oversight (Table 10). The percentage of concluded recommendations is 97.5%, with the remaining recommendations still under the Executive Yuan’s oversight (Figure 22).

Table 10 Transportation safety recommendations being overseen

Item	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected time 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, 2023
2	Mandarin Airlines, flight AE 369	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 zone of precision approach runways when sinking into grassy areas.	December 31, 2023
3-6	Mandarin Airlines, flight AE964	<ol style="list-style-type: none"> 1. Joint review and improvement of the drainage performance of the Taichung Airport runway pavement by the Air Force Command Headquarters under the Ministry of National Defense and the CAA (one task per agency, totaling two tasks). 2. Joint research into the feasibility of installing runway centerline lights at the Taichung Airport by the Air Force Command Headquarters under the Ministry of National Defense and the CAA (one task per agency, totaling two tasks). 	<ol style="list-style-type: none"> 1. In progress 2. In progress
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 runways to lower the	December 31, 2022

Item	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected time of completion
		risk of damage from aircraft running off the runway by reinforcing runway flatness, limiting aircraft operation conditions, advising carriers to reinforce training on 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 of airport runway improvement projects. For example, prioritize the handling of possible hazards caused by nonfragile objects and open trenches in the runway area to increase runway safety as soon as possible.	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 NA-706	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 unable to improve runway facilities.	December 31, 2022
12-14	Mandarin Airlines, flight AE788	<ol style="list-style-type: none"> 1. Joint improvement of the cross slope of the Taichung Airport runway pavement by the Air Force Command Headquarters under the Ministry of National Defense and the CAA (one task per agency, totaling two tasks) 2. Coordinate and cooperate with the 	<ol style="list-style-type: none"> 1. In progress 2. In progress

Item	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected time of completion
		CAA to research the installation of runway centerline lights at Taichung Airport.	

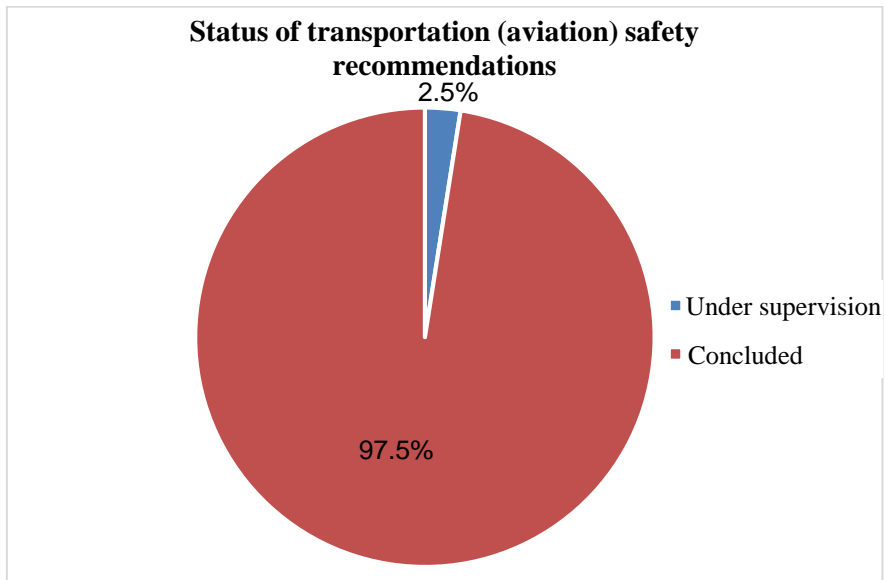


Figure 22 Status of transportation (aviation) safety recommendations

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 5700 kg or less.
2. Helicopter: helicopter of a maximum certificated take-off mass of 3175 kg or less.

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: non-power-driven, one lighter-than-air aircraft, includes inflatable free balloon and hot-air free balloon.

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 occurrences: 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 occurrences¹⁶

- 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:
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;

¹⁶ Defined by the TTSB in conjunction with the MOTC, then submitted to the Executive Yuan for approval, effective August 1, 2019

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 Category¹⁷

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

¹⁷ As of 2018, occurrence categories refer to the 2017 version, not the 2004 version.

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- 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		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
National Airlines	Number of airlines	13	15	15	18	18	18	16	15	17	17	
	Civil air transport carriers	8	8	8	10	9	9	8	8	9	8	
	General aviation carriers	7	9	9	11	11	11	10	10	11	12	
	Number of airworthy aircraft	199	210	234	249	255	260	263	274	278	270	
Civil aviation services	Passenger count	Domestic routes	5,192,341	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
		International routes	20,708,375	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
		Total	25,900,716	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
	Cargo weight in tons	Domestic routes	51,462	49,034	45,651	37,318	39,941	40,491	34,498	35,407	43,009	42,054
		International routes	1,728,436	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
		Total	1,779,898	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
	Number of flights	Domestic routes	87,703	84,933	87,939	89,316	84,455	87,257	79,638	90,731	98,887	79,666
		International routes	121,989	132,913	144,135	156,985	168,089	178,842	168,158	175,390	174,695	86,087
		Total	209,692	217,846	232,074	246,301	252,544	266,099	247,796	266,121	273,582	165,753
	Passenger helicopters	Flight hours	231.7	142.85	87.6*	167.2	137.8	148.1	211.3	193.3	122.1	137.4
		Number of flights	67	364	184*	440	383	468	646	246	102	268
		Passenger count	698	1,573	972*	2,010	1,852	2,287	3,204	2,735	1,009	1,415
	General aviation	Flight hours	4,724.1	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
	Taiwan national helicopters	Flight hours	3,230	3,084	2,090	1,935	1,317	1,675	1,587	1,058	1,347	1,351
		Number of flights	2,502	2,276	1,842	1,379	1,134	1,152	1,463	1,147	979	871

* 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			
2011	Air disaster relief Air search and rescue Air emergency medical services Air reconnaissance and patrol Air transportation	4,797	6,285:50	AS-365	10	BE-200	1
				BE-350	1	S-76B	2
				B-234	2	UH-1H	15
2012		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			

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	2011.02.26	EVA Air	A330-200	B-16303	BR757	None	0	0	Landing	RE	Pilot, weather	Brief runway excursion while landing at Taoyuan International Airport
2	2011.05.12	Uni Air	MD-90	B-17917	BR806	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Taoyuan International Airport
3	2011.06.28	Uni Air	DASH-8-300	B-15231	B7642	None	0	0	Landing	RI	Pilot, weather	Landing on a nondesignated runway at Tainan Airport
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	2012.09.13	EVA Air	A330-300	B-16331	BR189	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Songshan Airport

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
12	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
13	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
14	2013.06.03	China Airlines	A330-300	B-18317	CI781	None	0	0	Enroute	SCF-NP	System and equipment	Emergency descent after encountering abnormal cabin pressure 110 nautical miles northeast of Ho Chi Minh City
15	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
16	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
17	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
18	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
19	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
20	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
21	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
22	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

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
23	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
24	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
25	2015.02.05	Daily Air	DO-228	B-55565	DA7507	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Lanyu Airport
26	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
27	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
28	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
29	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
30	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
31	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
32	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
33	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
34	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

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
35	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
36	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
37	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
38	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
39	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
40	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
41	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
42	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
43	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
44	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
45	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
46	2019.05.30	China	A330-300	B-18352	CI922	None	0	0	Enroute	SCF-PP, F-NI	Other persons-	Engine fire alarm at cruising level 250 after departing Hong Kong International Airport and returning to Hong

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Incident category	Incident cause	Report title
		Airlines									maintenance	Kong
47	2019.12.25	Tigerair Taiwan	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, resulting in severe injuries to two cabin crew members
48	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

General Aviation Carriers

Order	Date	Airline	Aircraft model	Registration number	Operation	Aircraft damage	Fatalities	Serious injuries	Report titles
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
5	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
6	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
7	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
9	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
10	2018.03.15	Aerospace	Astra-SPX	B-20001	Tow target	None	0	0	Brief runway excursion while landing at Taichung International Airport

Order	Date	Airline	Aircraft model	Registration number	Operation	Aircraft damage	Fatalities	Serious injuries	Report titles
		Industrial Development Corporation							

National helicopters

Order	Date	Airline	Aircraft model	Registration number	Operation	Aircraft damage	Fatalities	Serious injuries	Report titles
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	Aircraft damage	Fatalities	Serious injuries	Report titles
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	Aircraft damage	Fatalities	Serious injuries	Report titles
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	Aircraft damage	Fatalities	Serious injuries	Report titles
1	2011.05.21	NASC	UH-1H	NA-511	Training	None	0	1	Sling malfunction resulting in personnel falling during training in Pingtung County
2	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
3	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
4	2017.06.30	NASC	UH-60M	NA-703	Training	None	0	1	Personnel injury from falling into the ocean during training at Taichung Port
5	2018.02.05	NASC	UH-60M	NA-706	Medical evacuation	Hull loss	6	0	Crashing into the ocean after taking off from Lanyu Airport
6	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
7	2018.12.05	NASC	AS365N3	NA-106	Suspension rescue	None	1	0	Death of personnel from injuries while performing suspension operations
8	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	2011.03.06	None	Quick Silver GT 400	None	Hull loss	0	1
2	2011.09.21	None	Storch	None	Hull loss	1	0
3	2015.03.16	Taiwan Ultra-Light Flights Development Association	RANS S-6 COYOTE II	PA-2002	Hull loss	2	0
4	2015.06.21	Taiwan Aviators Sports Association	HAWK ARROW II	None	Hull loss	0	1
5	2016.02.20	None	Super Bingo	None	Hull loss	0	0
6	2016.11.17	KaiXiang Aerosports Association	Remos GX	AJ-2666	Hull loss	0	1
7	2017.03.11	None	Storch	None	Hull loss	0	1
8	2018.01.06	None	N/A	None	Hull loss	0	0
9	2018.07.08	None	Skylark IIS	None	Hull loss	0	2
10	2018.09.02	None	N/A	None	Hull loss	1	0
11	2018.09.14	Chinese Taipei Powered Paragliding Association	LIFT M	PM-1052	Hull loss	1	0
12	2019.01.27	None	APCO LIFT EZ S	None	Hull loss	0	1

Drones

Order	Date	Owner	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

* 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 ¹⁸	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
2011	29.84	16	0.54	N/A	N/A	180,667	0	0.00	0	0.00
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
2011-2015	151.08	53	0.35	N/A	0.16	919,008	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

¹⁸ Source: [Aviation safety statistics](#) on Taiwan civil aviation turbojet airplanes, released on the official CAA website.

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

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 ¹⁹	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
2011	8.48	23	2.71	N/A	N/A	61,016	0	0.00	0	0.00
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
2011-2015	36.67	92	2.51	N/A	1.32	321,625	2	6.22	2	6.22
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

¹⁹ Source: [Aviation safety statistics](#) on Taiwan civil aviation turboprop airplanes, released on the official CAA website.

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

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

Year	ICAO	Taiwan		
	Incident rate	Departure ²⁰	Incident	Incident rate
	Per million departures	Occurrences	Occurrences	Per million departures
2011	4.2	241,683	0	0
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

²⁰ Source: [Aviation safety statistics](#) on total departures by Taiwan civil aviation turbojet and turboprop airplanes, released on the official CAA website.

2020	Incomplete	174,307	0	0
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Appendix 7 Hull loss and fatal incident rates in Taiwan's general aviation carriers

Year	Flight time ²¹	Hull loss	Hull loss rate	Fatal incident	Fatal incident rate
	Hours	Occurrences	Per 10,000 flight hours	Occurrences	Per 10,000 flight hours
2011	4,724	0	0.00	0	0.00
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
2011-2015	16,716	3	1.79	3	1.79
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

²¹ Source: [Aviation safety statistics](#) on total flight hours, excepting flight hours by helicopter passenger services, released on the official CAA website.

2016-2020	18,030	1	0.55	1	0.55
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Appendix 8 Hull loss and fatal incident rates of helicopters

Year	Flight hour ²²	Departure ²⁰	Hull loss	Hull loss rate		Fatal incident	Fatal incident rate	
	Hours	Occurrences	Occurrences	Per 10,000 hours	Per 10,000 departures	Occurrences	Per 10,000 hours	Per 10,000 departures
2011	3,230	2,502	0	0.00	0.00	0	0.00	0.00
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
2011-2015	11,656	9,133	2	1.72	2.19	2	1.72	2.19
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

²² Source: [Aviation safety statistics](#) on 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 time	Departure	Hull loss	Hull loss rate		Fatal incident	Fatal incident rate	
	Hours	Occurrences	Occurrences	Per 10,000 flight hours	Per 10,000 Departures	Occurrences	Per 10,000 flight hours	Per 10,000 Departures
2011	6,285.8	4,797	0	0.00	0.00	0	0.00	0.00
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	6,082.3	4,316	1	1.64	2.32	0	0.00	0.00
2011-2015	31,763	23,999	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	32,377	22,733	3	0.93	1.32	4	1.24	1.76