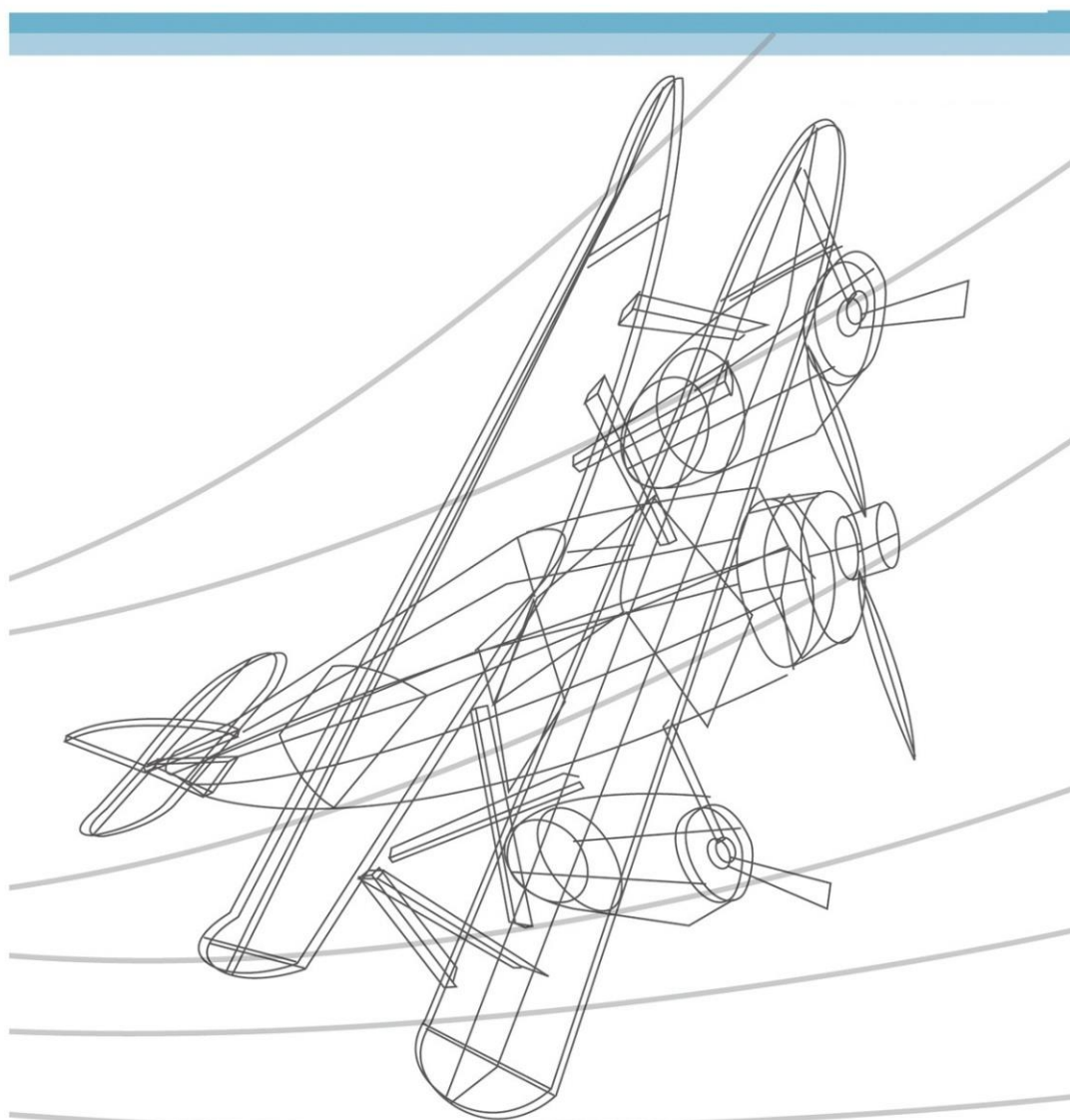


Taiwan Aviation Occurrence Statistics 2010–2019



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

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Abstract

2019 Occurrence Statistics

In 2019, national carriers were involved in five major aviation occurrences, four of which involved civil aviation aircraft. These occurrences did not result in fatalities or total damage to the hull and therefore did not meet the International Civil Aviation Organization's (ICAO) criteria for accidents. As a result, the fatal occurrence rate, hull loss rate, and accident rate for this year were all 0. One occurrence involving an ultra-light vehicle was reported, resulting in injuries to one person. No major aviation occurrences involving national civil aviation carriers, national helicopters, or public aircraft were reported in 2019.

Occurrence Statistics over the Past Decade (2010–2019)

From 2010 to 2019, national carriers were involved in 83 aviation occurrences. Civil aviation aircraft accounted for 50 occurrences, followed by 13 ultra-light vehicle occurrences, 10 occurrences with general aviation category aircraft, seven public aircraft occurrences, two flight trainer occurrences, and one free balloon occurrence. These occurrences resulted in a total of 117 fatalities.

Civil aviation turbojet airplanes in Taiwan have experienced no hull losses or fatalities over the past 10 years. Therefore, the 5-year moving average hull loss rate and fatal occurrence rate has remained at 0, outperforming the International Air Transport Association's (IATA) 2014–2019 global turbojet hull loss and casualty rates (which were 0.23 and 0.09, respectively).

Because of occurrences involving civil aviation turboprop airplanes resulting in hull loss and fatalities in 2014 and 2015 (TransAsia Airways GE222 and GE235), the 5-year moving average of hull loss occurrences increased in 2014 to 3.15 occurrences per million departures and again in 2015 to 6.22 occurrences per million departures. In the current report, the 2014 GE222 crash is no longer included in the moving average; therefore, the 5-year moving average for 2015–2019 hull loss occurrences has dropped to 3.02 occurrences per million departures; the same is true for fatal occurrence rates. Over the past 10 years, the 5-year moving average of IATA's global turboprop hull loss and fatal occurrence rates have displayed a downward trend; the 2015–2019 average hull loss rate was 0.98 occurrences per million departures and the fatal occurrence rate was 0.64 occurrences per million departures, which were better than Taiwan's civil aviation turboprop airplane occurrence rate.

Of the 50 major aviation occurrences involving national civil aviation aircraft in the past decade, nine meet the ICAO's definition of an accident: five occurrences

involved turbojets, resulting in two severe injuries; four occurrences involved turboprops, with two occurrences resulting in hull loss and a total of 91 fatalities. According to the ICAO flight phase taxonomy, 22 occurrences happened in the en route phase, followed by 21 occurrences in the landing phase. Furthermore, according to the ICAO occurrence category, runway excursion had the highest occurrence rate at 16 occurrences, followed by 14 occurrences involving system/component failure or malfunction (non-powerplant). According to the classification of occurrences by the US National Transportation Safety Board's causes and factors, most of these occurrences were "human-related" (46.7%), followed by "environment-related" (28%) and "aircraft-related" (23%).

The four occurrences of hull loss involving national general aviation aircraft in the past 10 years all resulted in fatalities. The 5-year moving average of hull loss and fatal occurrence rates trended upward prior to 2017, reaching 2.58 occurrences per 10,000 flight hours at its peak. Beginning in 2018, the moving average began to decline and has reached a low of 1.21 occurrences per 10,000 flight hours in 2019.

National helicopters were involved in three hull loss occurrences in the past 10 years, which all resulted in fatalities. The 5-year moving average for hull loss and fatal occurrence rates rose yearly prior to 2017, reaching a peak of 3.49 occurrences per 10,000 flight hours, or 4.30 occurrences per 10,000 departures. In 2018, the 5-year moving average dropped to 2.64 occurrences per 10,000 flight hours, or 3.19 occurrences per 10,000 departures, then rose again in 2019 to 2.86 occurrences per 10,000 flight hours, or 3.40 occurrences per 10,000 departures.

National public aircraft were involved in two hull loss occurrences and four occurrences with casualties in the past 10 years. The 5-year moving average of hull loss and fatal occurrence rates was 0 in both 2014 and 2015, then began to rise in 2016. As of 2019, the hull loss rate has peaked at 0.61 occurrences per 10,000 flight hours, or 0.86 occurrences per 10,000 departures. The fatal occurrence rate began to rise gradually in 2016, then rose drastically in 2018 to a peak of 1.23 occurrences per 10,000 flight hours, or 1.72 occurrences per 10,000 departures, in 2019.

National ultra-light vehicles were involved in 13 major aviation occurrences in the past 10 years, all resulting in vehicular hull loss; four of the occurrences were fatal occurrences that resulted in five deaths.

Historical Transportation Safety Recommendations and Statistics

Prior to being reorganized as the Taiwan Transportation Safety Board (TTSB), and from its establishment (in 1998) until the end of 2019, the Aviation Safety Council had concluded investigations into 128 major aviation occurrences and proposed 1,053

recommendations to improve transportation safety. The greatest proportion of the recommendations were targeted at government-affiliated agencies (approximately 53.0%), followed by aviation businesses (approximately 35.8%) and international institutions (approximately 11.2%). Of the 1,053 recommendations, 97.3% have been concluded, and the remaining 2.7% (15) are being overseen by the Executive Yuan.

Introduction

The first section of this report summarizes the operations of national aircraft in 2019 and over the past 10 years (2010–2019). Topics include domestic airlines and the number of aircraft, civil aviation enterprises, general aviation enterprises, ultra-light vehicles, flight training organizations, free balloons, and public aircraft.

The second section, which is the focus of this year’s aviation safety statistic report, offers a general overview of the statistics and analysis of aviation occurrences. The section first provides a basic introduction, which includes data courses, 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 aviation enterprises, national general aviation enterprises, national helicopters, Taiwan’s public aircraft, and ultra-light vehicles.

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

This report employs civil aviation jargon and statistics terminology common among international organizations; relevant definitions and descriptions are provided in the appended glossary.

I. Operational Overview of National Aircraft¹

1.1 Domestic Airlines and the Number of Aircraft

From 2010 to 2019, the number of civil aviation enterprises in Taiwan increased from eight to nine². During this time, domestic airlines entered and exited the market, including the establishment of V Air and Tigerair Taiwan in 2014 and the deregistration of SunRise Airlines and V Air as civil aviation enterprises in 2015 and 2017, respectively. During this period, TransAsia Airlines declared bankruptcy, Emerald Pacific Airlines was registered as a civil aviation enterprise in 2018, and Starlux Airlines was established in 2019. Two of the airlines³ also operate helicopter transportation services.

Taiwan's general aviation airline companies increased from 7 in 2010 to 11⁴ in 2019. Market changes included the establishment of Executive Aviation and Avanti Aviation in 2012, the launch of SkyRainbow Airlines and the EVA's acquisition of a general aviation operating permit in 2014, the deregistration of SunRise Airlines' general aviation license in 2017, and the addition of TDA Air.

Three airlines⁵ operate both civil aviation services and general aviation services; therefore, Taiwan has a total of 17 airlines. The fluctuating number of Taiwanese airlines from 2010 to 2019 is illustrated in Figure 1; the operational overview indices over the past 10 years are presented in Appendix 1.

¹ 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.

² China Airlines, EVA Air, Uni Air, Mandarin Airlines, Far Eastern Air Transport, Tigerair Airlines, Starlux Airlines, Daily Air, and Emerald Pacific Airlines.

³ In addition to operating scheduled or nonscheduled transport service on domestic offshore and outlying air routes, Daily Air also operates scheduled or nonscheduled helicopter transport services on domestic routes; Emerald Pacific Airlines operates helicopter transport services on domestic routes.

⁴ 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, and TDA Air.

⁵ Daily Air, Emerald Pacific Airlines, and EVA Air.

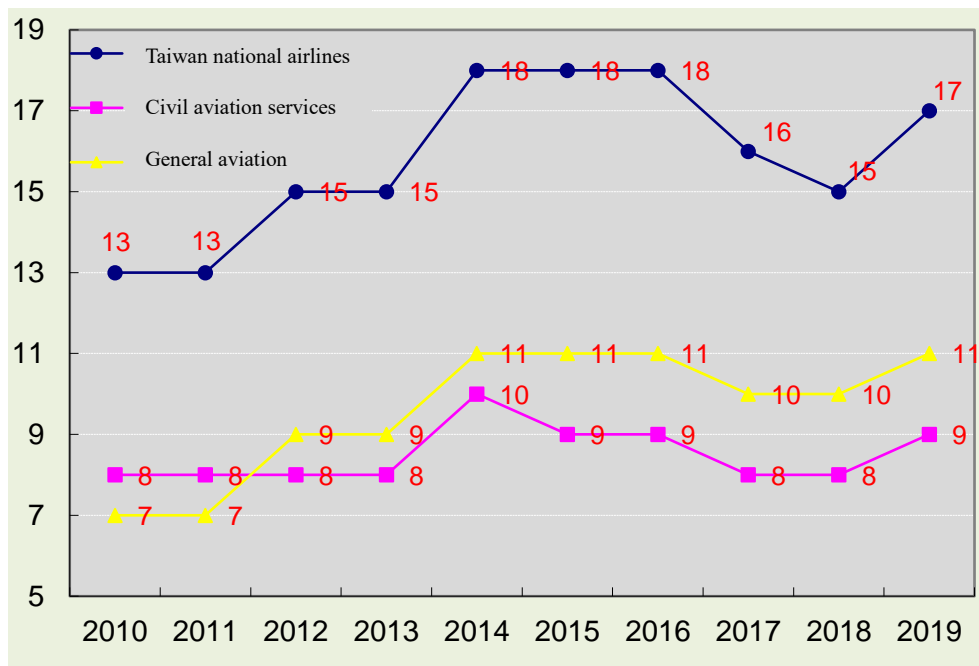


Figure 1 Civil and general aviation enterprises

Over the past 10 years, the number of aircraft registered in Taiwan has increased steadily, mainly due to airlines expanding their fleets and the continual introduction of hot air balloons in Taiwan. The number of airworthy aircraft is depicted in Figure 2. As of 2019, Taiwan has 278 airworthy aircraft and 291 registered aircraft.

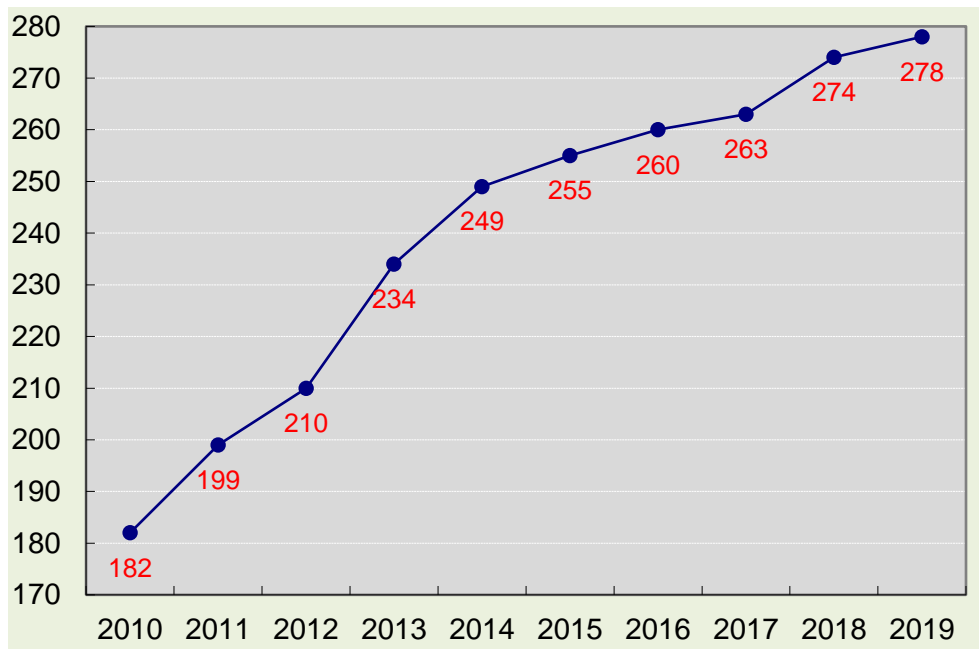


Figure 2 Number of airworthy aircraft in airline fleets

1.2 Civil Aviation Carriers

Passenger Transportation

In 2019, civil aviation airlines in Taiwan carried approximately 38.52 million passengers, a 1.6% increase from 2018. Approximately 32.41 million passengers travelled on international and cross-strait routes, accounting for 84.1% of passengers, a 0.8% increase from 2018; 6.1 million passengers travelled on domestic routes, accounting for 15.9% of total passengers, a 5.6% increase from 2018.

Figure 3 presents the 2010–2019 trends in civil aviation passengers in Taiwan. Over the past 10 years, the overall number of passengers has increased from approximately 25.43 million in 2010 to approximately 38.52 million in 2019, a growth rate of 51.5%. International and cross-strait routes have increased yearly from approximately 20.6 million passengers in 2010 to its highest number of passengers in 2019, a growth rate of 57.3% over 10 years. Domestic routes had 4.82 million passengers in 2010 and, after a slight decline and recovery in 2015, achieved a 10-year passenger growth rate of 26.6%.

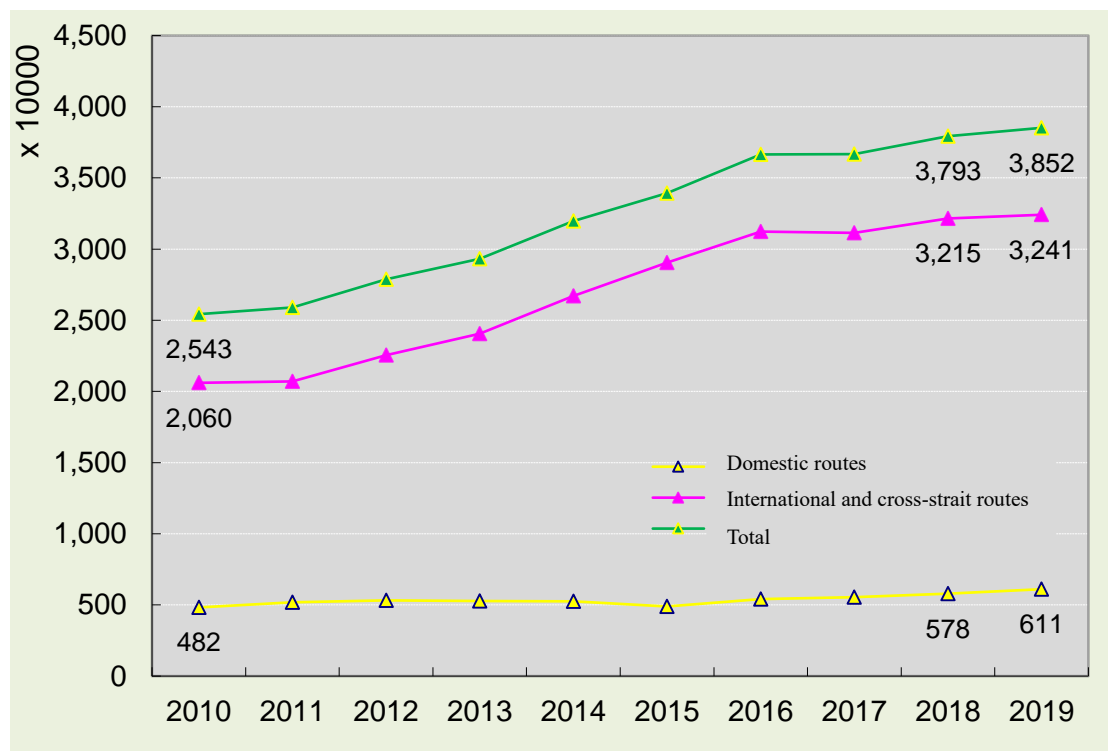


Figure 3 Civil aviation passengers

Freight

In 2019, civil aviation enterprises in Taiwan transported approximately 2.07 million tons of air cargo, a 7.2% decline from the previous year. Approximately 2.03 million tons were transported on international and cross-strait routes, far surpassing air cargo on domestic routes and accounting for 97.9% of total air cargo. International air cargo fell 7.7% from 2018 levels. Approximately 43,000 tons of air cargo was carried on domestic routes, accounting for 2.1% of total air cargo and a 21.4% increase from 2018.

Figure 4 presents trends in air freight by Taiwanese civil aviation companies from 2010 to 2019. The overall cargo load increased from approximately 1.92 million tons in 2010 to approximately 2.07 million tons over the past 10 years, a growth rate of 7.9%. International and cross-strait routes transported approximately 1.87 million tons of cargo in 2010. The cargo loads declined from 2011 to 2013 and in 2015, followed by substantial growth in 2017. In 2018, local airlines transported the highest ever cargo load of 2.2 million tons, representing a 10-year growth of 8.6% in total cargo tonnage. After transporting 51,000 tons of cargo in 2010, domestic routes exhibited an 18.5% decline in total cargo tonnage over the past 10 years.

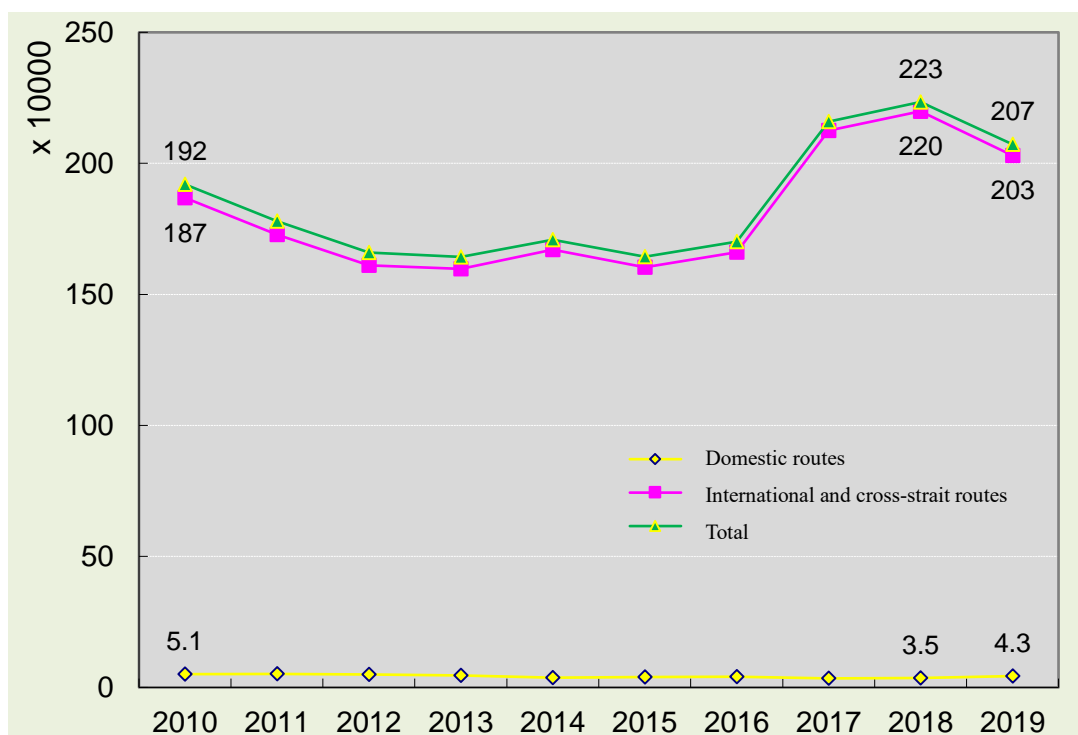


Figure 4 Air freight by Taiwanese civil aviation carriers

Number of Flights

Civil aviation carriers in Taiwan operated a total of approximately 273,600 flights in 2019, a 2.8% increase from 2018. Approximately 174,700 of these flights were on international and cross-strait routes, accounting for 63.9% of all flights, a 0.4% decrease from 2018. Approximately 98,900 flights were operated on domestic routes, accounting for 36.1% of all flights, a 9% increase from 2018.

Figure 5 depicts trends in flights by civil aviation carriers from 2010 to 2019. The total number of flights increased from approximately 203,000 flights in 2010 to 273,600 flights in 2019, a growth rate of 34.7%. The number of flights on international and cross-strait routes rose from 120,000 flights in 2010 to a peak of 178,800 flights in 2016, exhibiting a 10-year growth rate of 45.6%, despite a slight decline in 2017. In 2010, approximately 83,000 flights operated on domestic routes, which demonstrated an overall moderate upward trend. Except for a decline in 2017, the number of flights continued its upward trajectory, peaking at 98,900 flights in 2019, a 10-year growth rate of 19.1%.

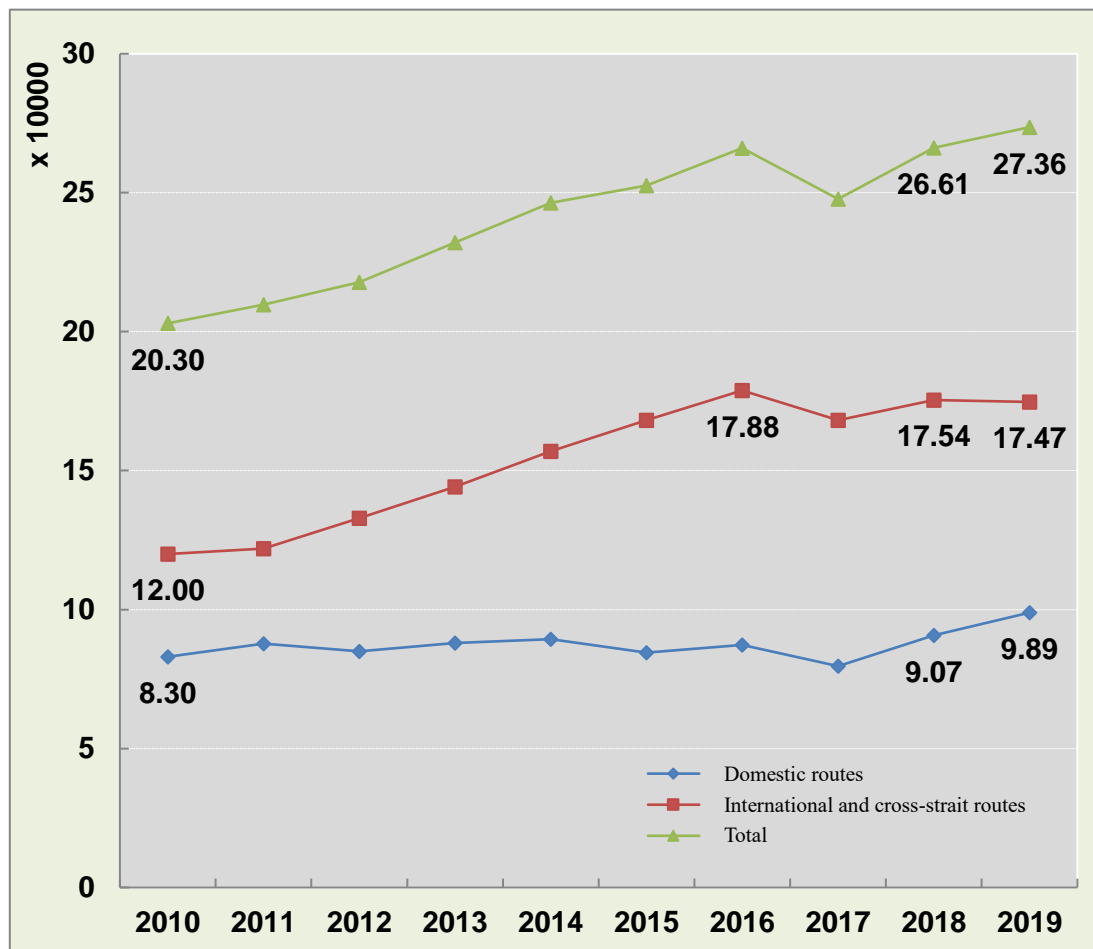


Figure 5 Flights by civil aviation carriers

1.3 General Aviation Carriers

General aviation carriers in Taiwan logged a total of 5,053 flight hours in 2019, a 7.7% reduction compared with 2018. The 2010–2019 trend in flight hours among general aviation carriers in Taiwan is presented in Figure 6⁶; 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 in 2019; the 10-year growth rate was 12.1%.

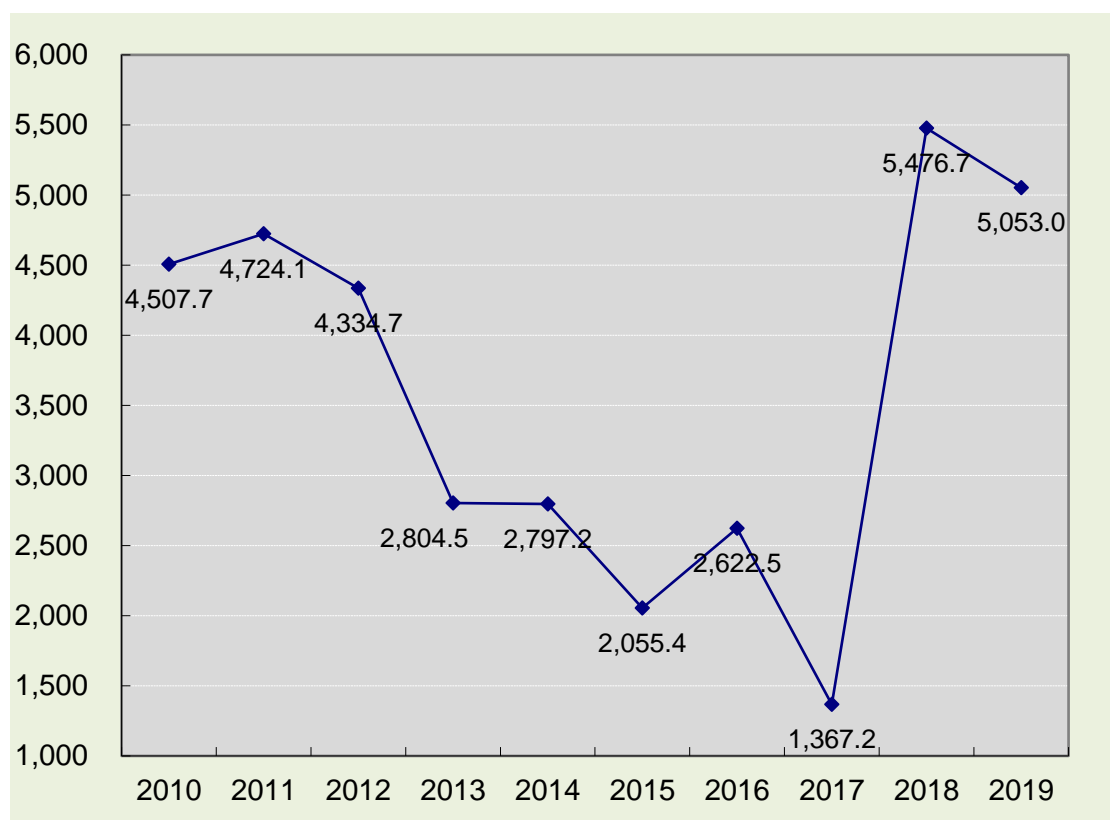


Figure 6 Flight hours by general aviation enterprises

⁶ The general aviation enterprise 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 enterprises.

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 2019, the Civil Aeronautics Administration (CAA) has announced 22 airspaces for ultra-light vehicles, 10 approved active airspaces, five air fields available for legal flying activities (Wuri, Taichung City; Jiho, Pingtung County; Huatong, Hualien; Matai'an, Hualien County, Wang'an, Penghu County), and seven groups that can legally engage in flying activities with ultra-light vehicles (Chinese Taipei Aviation League, Chinese Taipei Powered Paragliding Association, Hualien Aeronautic Association, Hualien Ultra-light Sports Association, KaiXiang Aerosports Association, Taiwan Taiya Aeronautical Tourism and Development Association, and Taiwan Recreational Aviation Association).

1.5 Flight Training Institutions

Apex Flight Academy was established on September 24, 2014, and is Taiwan's first flight academy to have passed the 5-stage review of the CAA. Apex's flight operations and maintenance base and training facilities are situated at the Taitung FongNien airport and is equipped with academic and technical training classrooms. 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 2019, Apex Flight Academy has registered seven aircraft, six of which are airworthy.

1.6 Free Balloons

Free balloons (including free air balloons and hot air balloons) refer to 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 2019, 18 free balloons has received certificates of registration in Taiwan, 15 of which are airworthy.

1.7 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 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, on both land and sea.

As of the end of 2019, the NASC has 18 aircraft: 17 helicopters and one fixed-wing aircraft. The number of flights and total flight hours of 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 lower, decreasing by 22.2% and 31.1%, respectively, over the past 10 years.

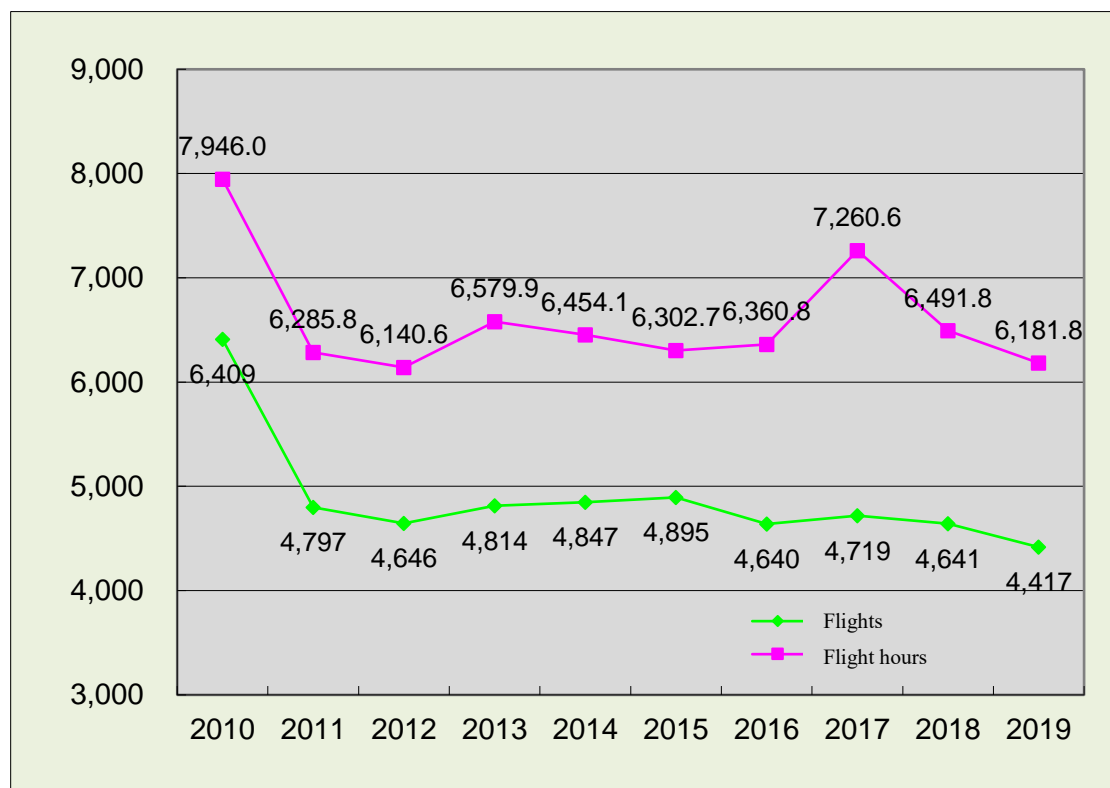


Figure 7 Number of flights and flight hours by NASC aircraft

II. Statistical Analysis of Major Aviation Occurrences

2.1 Basic Description

Information Source

The information in this section is derived from the TTSB's investigation reports on major aviation occurrences, statistics on aviation safety from the CAA, statistics from the NASC, annual safety reports from IATA, and the annual safety reports from the ICAO.

Definitions and Classifications

The aviation terminology used in this report are 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 analysis on civil aviation occurrences were performed according to the classification methods of IATA⁷, ICAO, and the US National Transportation Safety Board (NTSB).

- IATA guidelines were used to calculate the hull loss and casualty rates of civil transportation turbojet and turboprop aircraft with maximum takeoff weights of 5,700 kg or more, using per million departure over 5 consecutive years⁸ 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 occurrence 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. Because no comparative international statistics are available for these statistics, these aviation categories are discussed mainly on the basis of their observed trends.

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

⁷ Information on accident occurrence rates released by the CAA uses the same categories as IATA and a 5-year moving average to calculate the hull loss rate of civil aviation turbojet and turboprop airplanes with maximum take-off weights of 5,700 kg or more.

⁸ As of 2015, IATA only provides data on global departures and no data on flight times.

- Turbojet airplanes for civil aviation use, popularly known as commercial turbojet airplanes (maximum takeoff weight of 5,700 kg or more, see Table 1)
- Turboprop airplanes for civil aviation use (maximum takeoff weight of 5,700 or more, see Table 2)
- Public aircraft (see Table 3)
- General aviation aircraft (not including hot air balloons, see Table 4)
- Helicopters (see Table 5)

Table 1 Commercial turbojet airplane models

AIRBUS	BOEING	EMBRAER
A320	737	ERJ-190
A330	747	
A340	777	
A350	787	
	MD-11	
	MD-80	

Table 2 Civil aviation turboprop airplane models

ATR	DORNIER	DE HAVILLAND (BOMBARDIER)
ATR72	DO-228	DASH-8
		DHC-6

Table 3 Public aircraft models

Airplanes	Helicopters
BEECH-350	AS-365
	UH-1H
	UH-60M

Table 4 General aviation aircraft models

Airplanes		Helicopters
737	EMB-505	AW169
ASTRA-SPX	G280	BELL-206
BD-700	GVI	BK-117
BEECH-200	GV-SP	
BN-2	HAWKER 400XP	
CENSNA-208	P68-C-TC	
EMB-135		

Table 5 Helicopter models

AW169	BELL-206	BK-117
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2.2 Overview of Major Aviation Occurrences

Taiwan national aircraft were involved in five major aviation occurrences in 2019. Four occurrences involved civil aviation enterprises and did not result in fatalities. One occurrence involving an ultra-light vehicle resulted in serious injuries to one person. The statistics are presented in Table 6.

Table 6 Major aviation occurrences in 2019

Category	Aviation occurrence			Fatalities	
	Total cases	Fatal occurrences	Hull losses	Total people	People on board
Commercial turbojet airplanes	3	0	0	0	0
Turboprop airplanes	1	0	0	0	0
Civil aviation category (total)	4	0	0	0	0
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	1	0	1	0	0
Public aircraft	0	0	0	0	0
Total	5	0	1	0	0

From 2010 to 2019, national aircraft were involved in 83 major aviation occurrences. Aircraft in the civil aviation category accounted for 50 occurrences (the majority), followed by 13 ultra-light vehicle occurrences, 10 occurrences with general aviation category aircraft, seven public aircraft occurrences, two flight trainer occurrences, and one 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 on major flight occurrences involving national aircraft in the past 10 years

Category	Major flight occurrences			Fatalities	
	Total cases	Fatal occurrences	Hull loss	Total cases	Fatal occurrences
Commercial turbojet airplanes	38	0	0	0	0
Turboprop airplanes	12	2	2	91	91
Civil aviation category (total)	50	2	2	91	91
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	13	4	13	5	5
Public aircraft	7	4	2	10	10
Total	83	14	22	117	117

2.3 Major Occurrences Involving Civil Transportation Aircraft

2.3.1 5-year Moving Occurrence Rate of Turbojet Airplanes

5-year Moving Averages of Hull Loss Rates

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

In 2019, turbojet airplanes in the Taiwan civil aviation industry were not involved in any hull loss occurrence. 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, almost halving from 0.43 occurrences per million departures in the 2010–2014 period to 0.23 occurrences per million departures in the 2015–2019 period (Figure 8). Please see Appendix 4 for the detailed statistics.

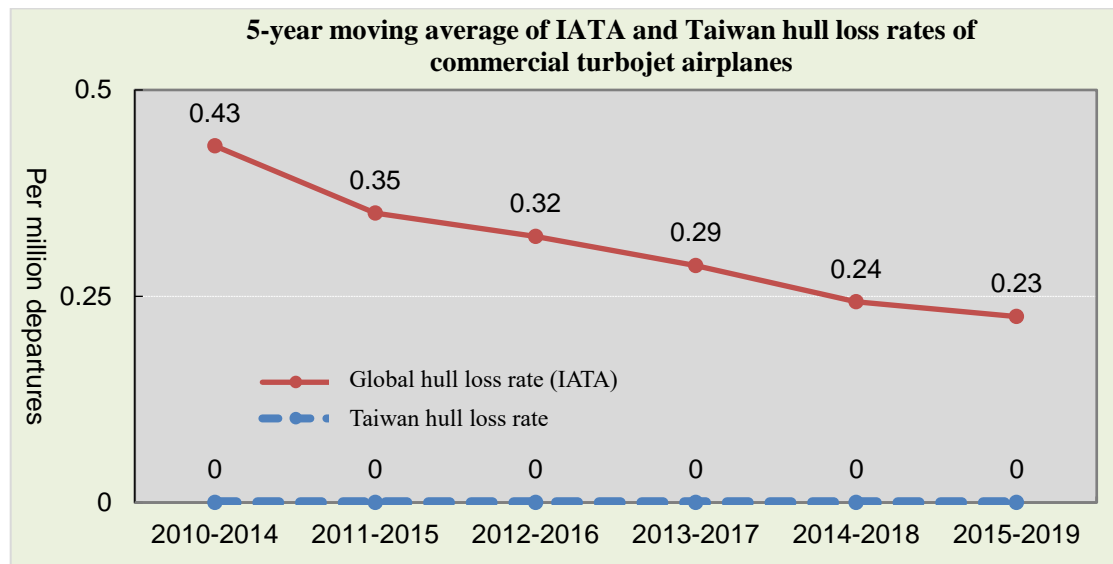


Figure 8 IATA and Taiwan hull loss rates of civil transportation turbojet airplanes

5-year Moving Averages of Fatal Occurrence Rates

Commercial turbojet airplanes in Taiwan were not involved in any fatal occurrence over the past 10 years, and therefore the 5-year moving average has remained at 0. IATA's 5-year moving average of the global rate of fatal occurrences involving turbojet airplanes has exhibited a downward trend, decreasing by more than 50% from 0.23 occurrences per million departures in the 2010–2014 period to 0.09 occurrences per million departures in the 2015–2019 period (Figure 9). Please see Appendix 4 for the 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.

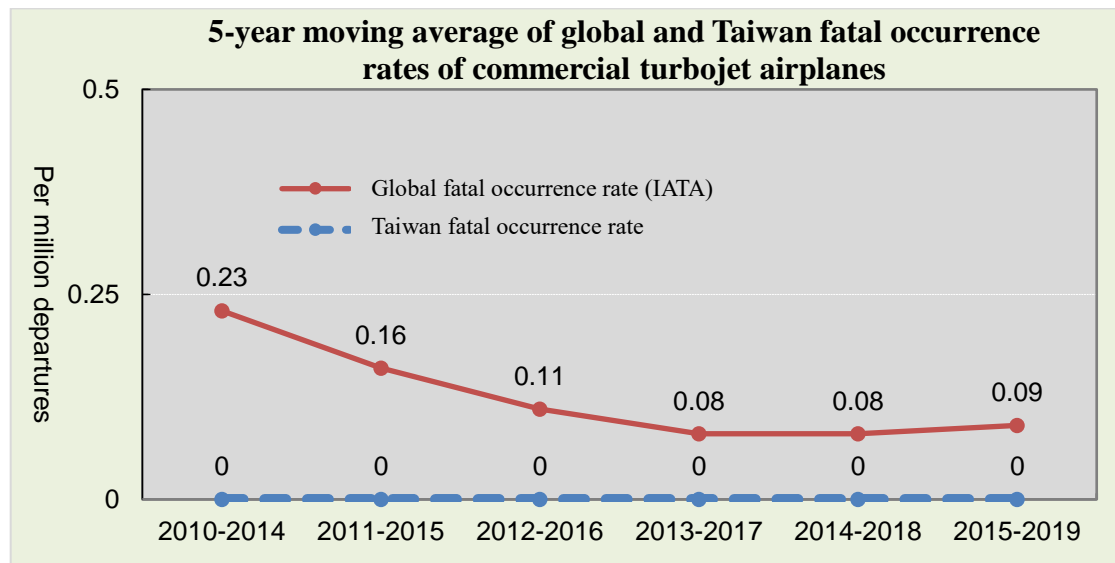


Figure 9 Global (IATA) and Taiwan hull loss rates of civil aviation turbojet airplanes

2.3.2 5-year Moving Occurrence Rate of Turboprop Airplanes

5-year Moving Averages of Hull Loss Rates

The 5-year moving average of the hull loss occurrence rate for civil aviation turboprop airplanes in Taiwan remained at 0 in the 2003–2013 period, but following aviation occurrences in 2014 and 2015 that resulted in hull loss (TransAsia Airways GE222 and GE235), the 5-year moving average increased in 2014 to 3.15 occurrences per million departures and again in 2015 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.

In the current report, the 2014 GE222 crash 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.

The 5-year moving average of IATA’s global turboprop hull loss occurrence rates (Figure 10) have trended downward by more than 60%, dropping from 2.73 occurrences per million departures in the 2010–2014 period to 0.98 occurrences per million departures in the 2015–2019 period. The detailed statistics are presented in Appendix 5.

According to IATA, turboprop airplanes have 10 times the hull loss occurrence rate of turbojet airplanes.

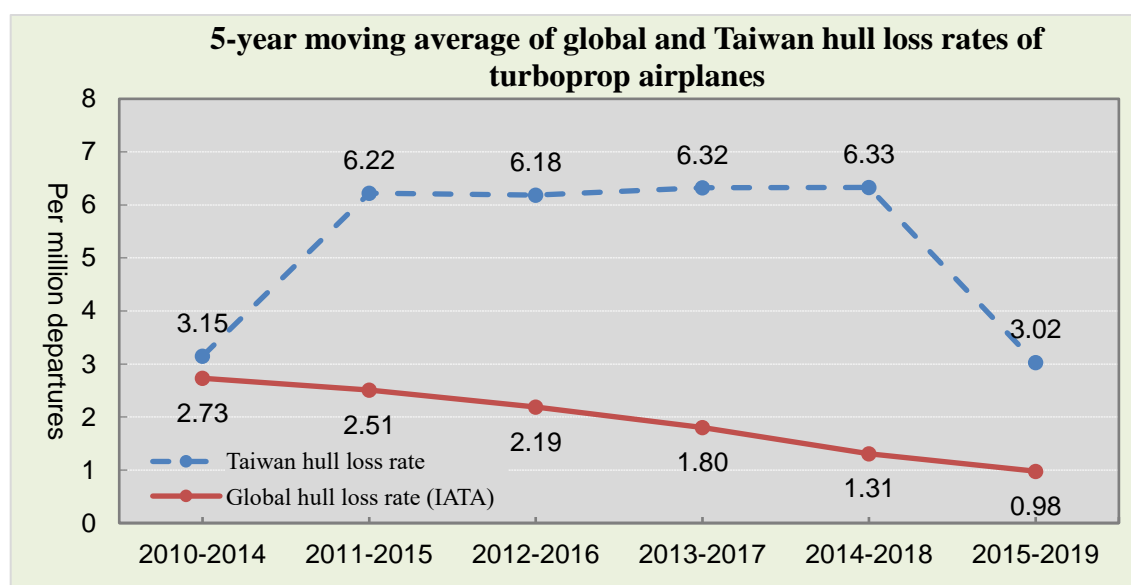


Figure 10 Global (IATA) and Taiwan hull loss rates of civil transportation turboprop airplanes

5-year Moving Averages of Fatal Occurrence Rates

The 5-year moving average of the fatal occurrence rate for civil aviation turboprop airplanes in Taiwan remained at 0 in the 2003–2013 period. However, following occurrences in 2014 and 2015 that resulted in fatalities, the 5-year moving average increased in 2014 to 3.15 occurrences per million departures and again in 2015 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.

The 2014 fatal occurrence is no longer included in the most recent moving average; therefore, the 5-year moving average for 2015–2019 hull loss occurrences dropped to 3.02 occurrences per million departures.

The 5-year moving average of IATA’s global turboprop fatal occurrence rate (Figure 11) has trended downward by more than 60%, dropping from 1.86 occurrences per million departures in the 2010–2014 period to 0.64 occurrences per million departures in the 2015–2019 period. The detailed statistics are presented in Appendix 5.

According to IATA, turboprop airplanes have seven to eight times the fatal occurrence rate of turbojet airplanes.

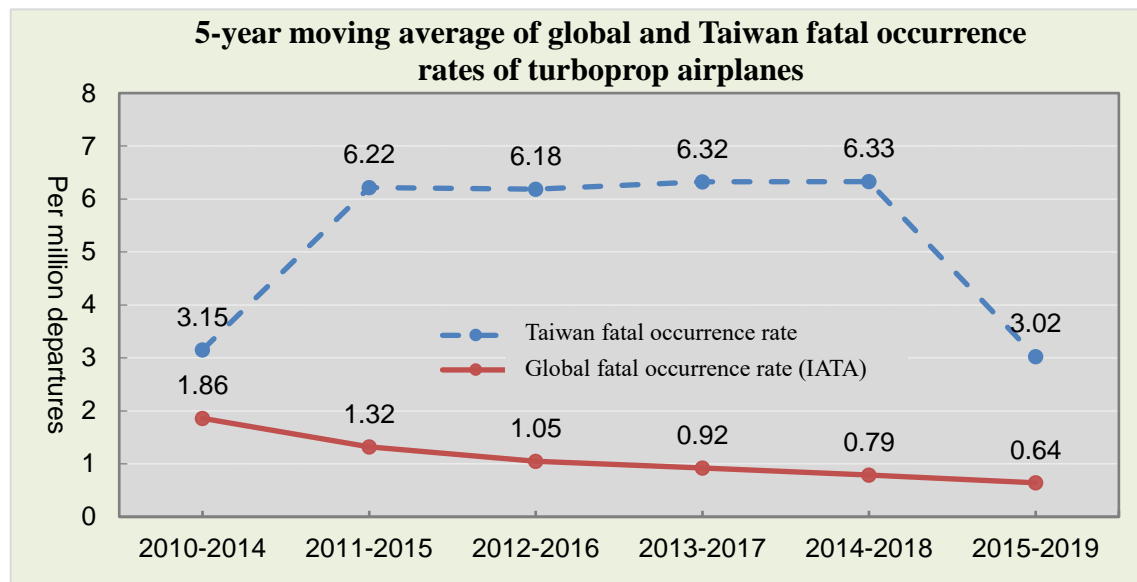


Figure 11 Global (IATA) and Taiwan fatal occurrence rates of civil aviation turboprop airplanes

2.3.3 Annual Airplane Accident Rates

According to the ICAO's definition of an accident (see appendix)⁹, nine of the major aviation occurrences involving civil aviation aircraft in the 2010–2019 period¹⁰ are considered accidents (Table 8). Five of the accidents involved turbojet airplanes, resulting in two severe injuries. Turboprop airplanes were involved in four of the accidents, two of which resulted in hull loss and a total of 91 fatalities.

Table 8 Commercial aviation accidents involving Taiwanese aircraft over the past 10 years

No.	Date	Model	Occurrence location	Flight phase	Damage to aircraft	Fatalities	Injuries
1	2010.03.04	B747-400F	Ted Stevens Anchorage International Airport	Takeoff	Substantial damage	0	0
2	2012.05.02	ATR72-500	After taking off from Taipei Songshan Airport	En route	Substantial damage	0	0
3	2012.08.17	ERJ-190	Penghu Airport	Landing	Substantial damage	0	0
4	2014.07.23	ATR72-500	Penghu Airport	Approach	Hull loss	48	10
5	2015.02.04	ATR72-600	Keelung River in Nangang (Taipei)	En route	Hull loss	43	14
6	2016.10.01	A330-300	Taoyuan International Airport	Landing	Substantial damage	0	0
7	2017.04.13	DHC-6-400	Lanyu Airport, Orchid Island, Taitung (KYD)	Landing	Substantial damage	0	0
8	2017.11.22	B777-300ER	Japan controlled airspace	En route	None	0	2
9	2017.12.02	B777-300ER	Toronto Pearson International Airport	Taxi	Substantial damage	0	0

Figure 12 illustrates the number of accidents involving Taiwanese civil aviation airplanes, the rate of occurrences per million departures, and the ICAO global civil aviation accident rate¹¹. Please see Appendix 6 for more details.

⁹ 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 occurrence rate in the civil aviation industry.

¹⁰ Includes occurrences involving Taiwan national aircraft that occurred and were investigated overseas, except for one occurrence that happened during a training flight.

¹¹ As of the publication of this report, the ICAO had not completed its calculation of the 2019 global accident occurrence rate.

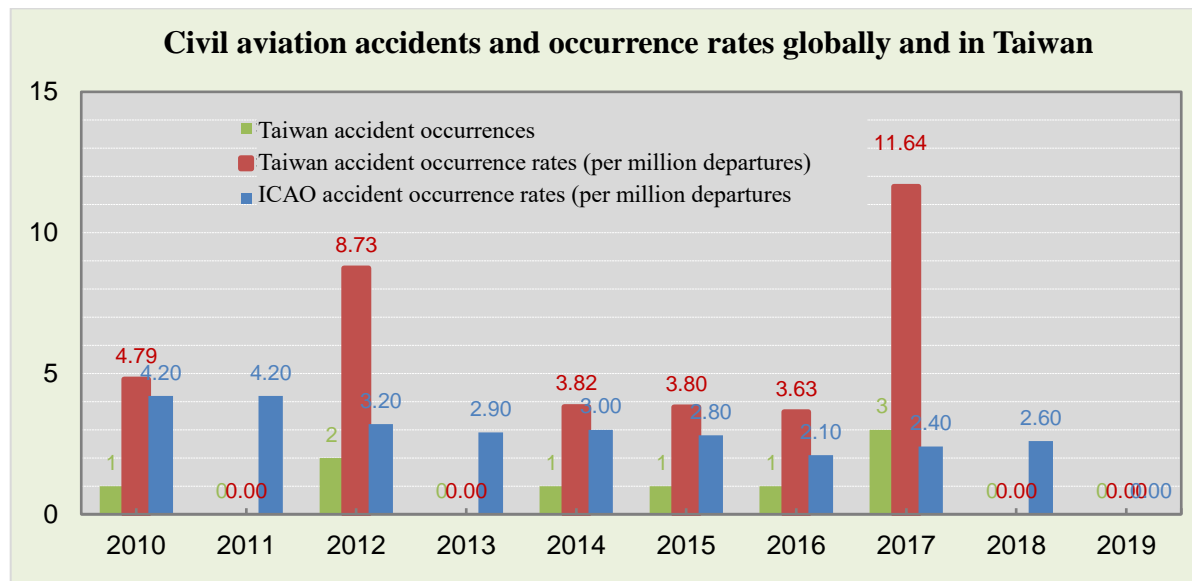


Figure 12 ICAO and Taiwan statistics on civil aviation accidents

2.3.4 Classification of Occurrences by Flight Phases

According to the flight phases defined by the ICAO, of the 50 major civil aviation occurrences in the past 10 years, 22 occurrences happened during the en route phase (the largest proportion), followed by 21 occurrences in the landing phase, as depicted in Figure 13.

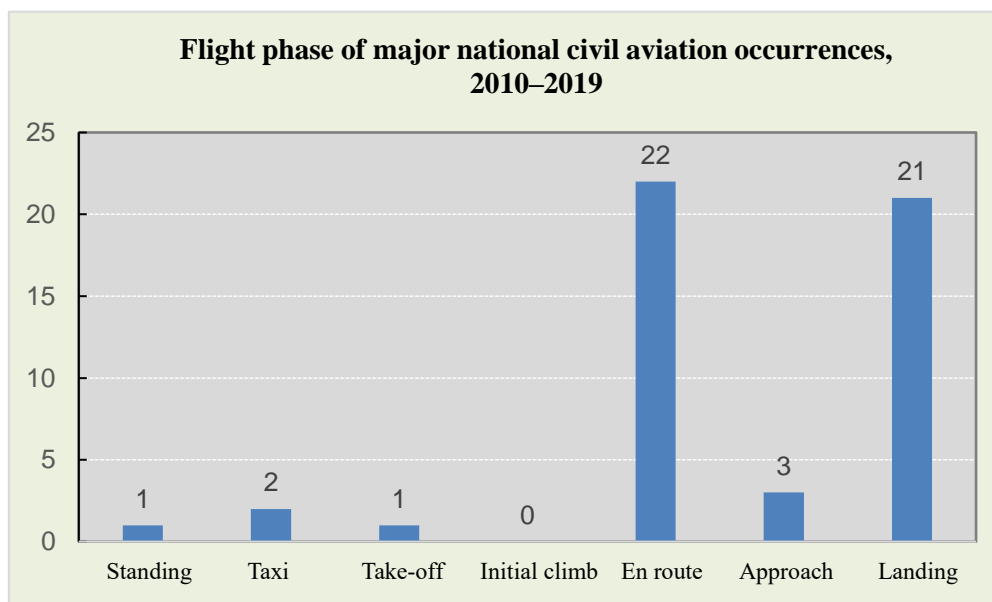


Figure 13 Flight phase of major civil aviation occurrences

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 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 50 major civil aviation occurrences are presented in Figure 14. The statistical results indicate that from 2010 to 2019, runway excursion had the highest occurrence rate at 16 occurrences, followed by 14 occurrences involving system/component failure or malfunction (non-powerplant).

Major civil aviation transport occurrences by category, 2010–2019

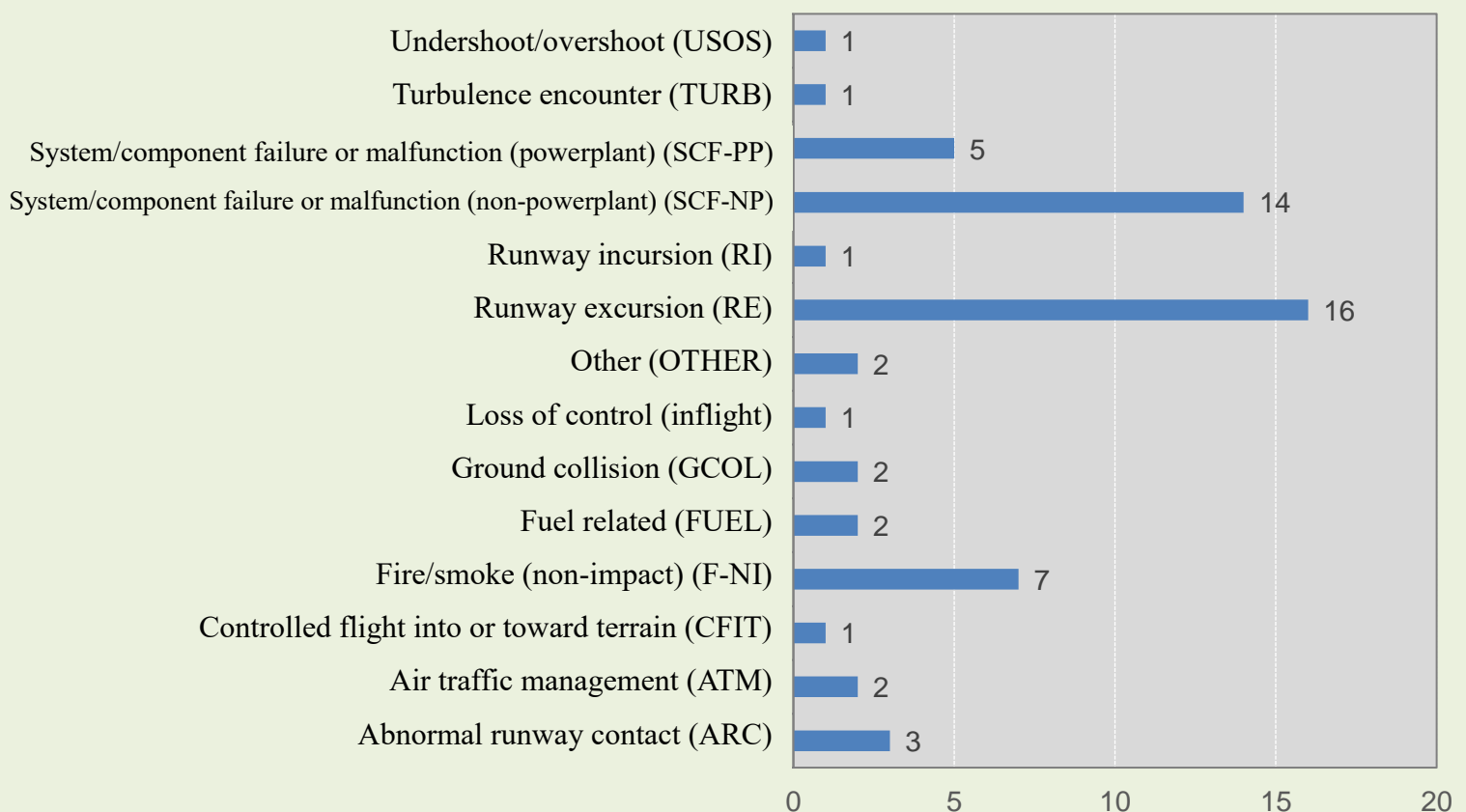


Figure 14 Major civil aviation transport occurrences by category

2.3.6 Occurrence Causes and Factors

The NTSB has three main categories of causes and 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 the weather, airport/ATC/navigation facilities, ATC and services, daytime/nighttime, and terrain. Aircraft-related causes and factors include systems and equipment, engines, structures, and performance.

According to findings of our investigation into possible causes and the NTSB’s causes and factors, each occurrence has at least one major cause; some occurrences may even 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 aviation occurrences over the past 10 years were human-related, at 46.7% with 35 cases (40% pilot-related and 6.7% related to maintenance workers, ground crew, cabin crew, ATC, or other personnel). Environment-related factors were involved in 21 cases, accounting for 28% of all occurrences (20% related to the weather and 8% related to airport/ATC/navigation facilities). Aircraft-related causes and factors were present in 19 cases, accounting for 25.3% of all cases (16% system and equipment-related, 5.3% engine-related, 1.3% structure-related, and 2.7% other factors).

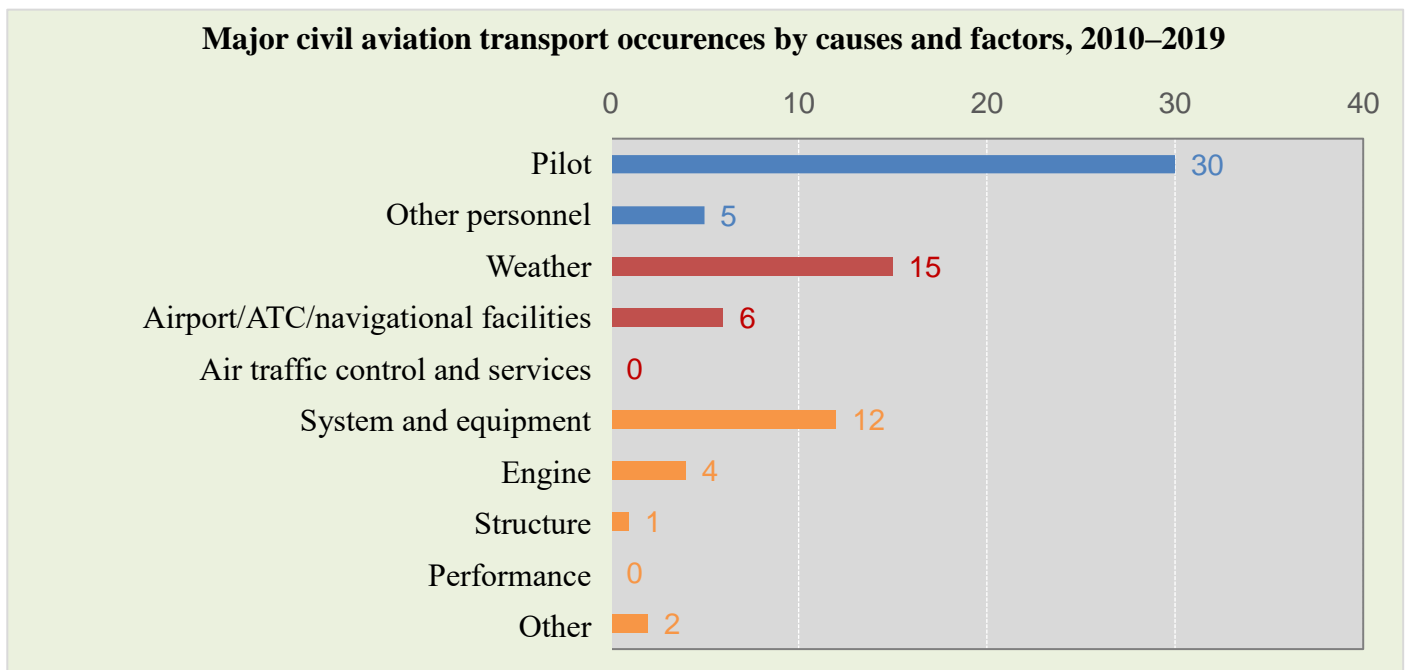


Figure 15 Major civil aviation transport occurrences by causes and factors

2.4 Major Aviation Occurrences in the General Aviation Industry

5-year Moving Average of Hull Loss and Fatal Occurrence Rates

In 2019, no major aviation occurrence was reported in Taiwan's general aviation industry. In the past 10 years, there were four occurrences of hull loss: 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 industry 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 2019, the 5-year moving average of the hull loss and fatal occurrence rates had dropped to 1.21 occurrences per 10,000 flight hours (Figure 16). The details are presented in Appendix 7.

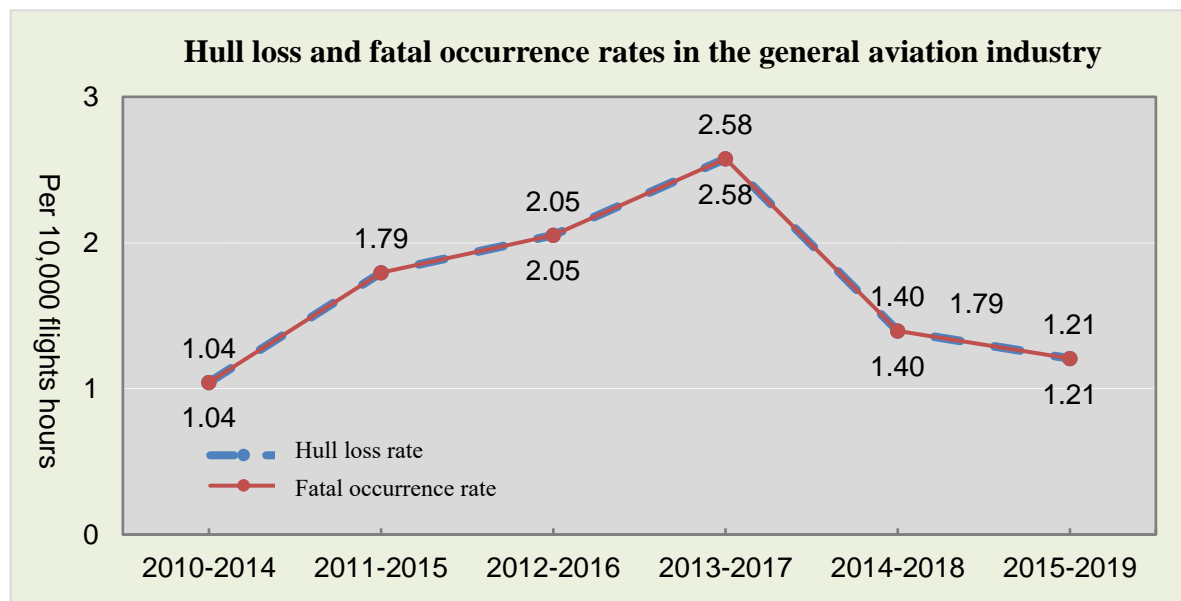


Figure 16 Hull loss and fatal occurrence rates in the general aviation industry

2.5 Major Occurrences Involving Helicopters

5-year Moving Average of Hull Loss and Fatal Occurrence Rates

Taiwan helicopters were not involved in any major aviation occurrence in 2019. 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 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 (Figure 17). The details are presented in Appendix 8.

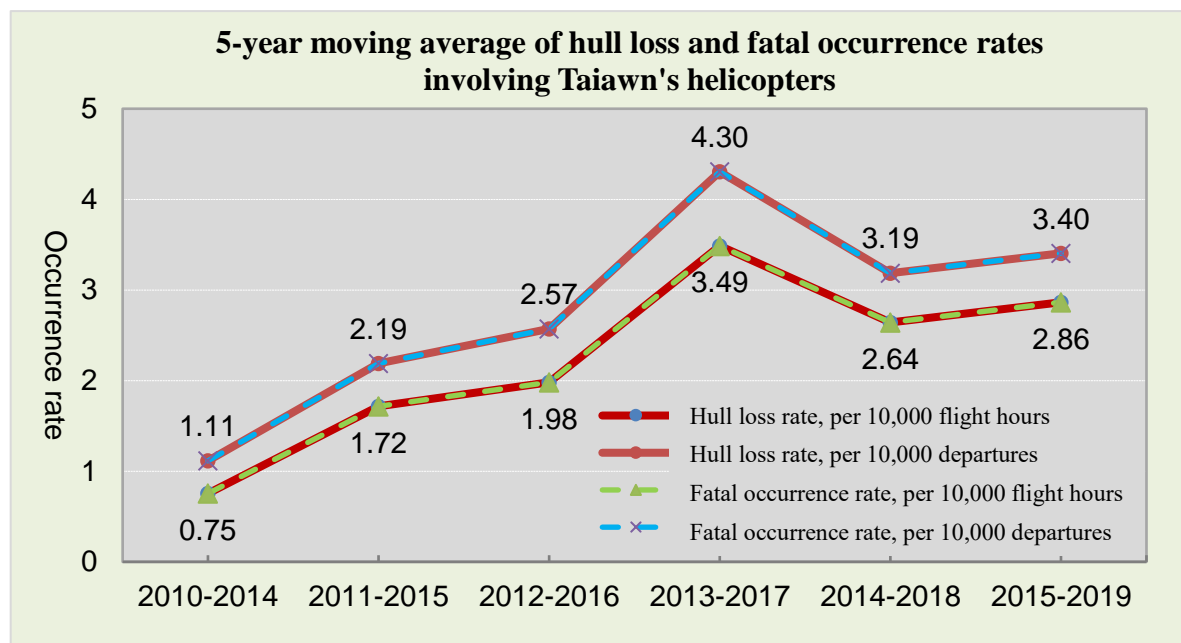


Figure 17 Hull loss and fatal occurrence rates involving Taiwan's helicopters

2.6 Major Occurrences Involving Public Aircraft

Taiwan public aircraft were not involved in any major aviation occurrence in 2019. Over the past 10 years, hull loss occurred once in 2016 and once in 2018, with one fatal occurrence in 2016 and three in 2018. The details are provided in Appendix 3.

5-year Moving Average of Hull Loss Rates

The 5-year moving averages of the hull loss rate of Taiwan public aircraft for the 2010–2014 and 2011–2015 periods were 0. Since 2016, the moving average has exhibited an upward trend, reaching a peak of 0.61 occurrences per 10,000 flight hours or 0.86 occurrences per 10,000 departures in 2019 (Figure 18). The details are presented in Appendix 19.

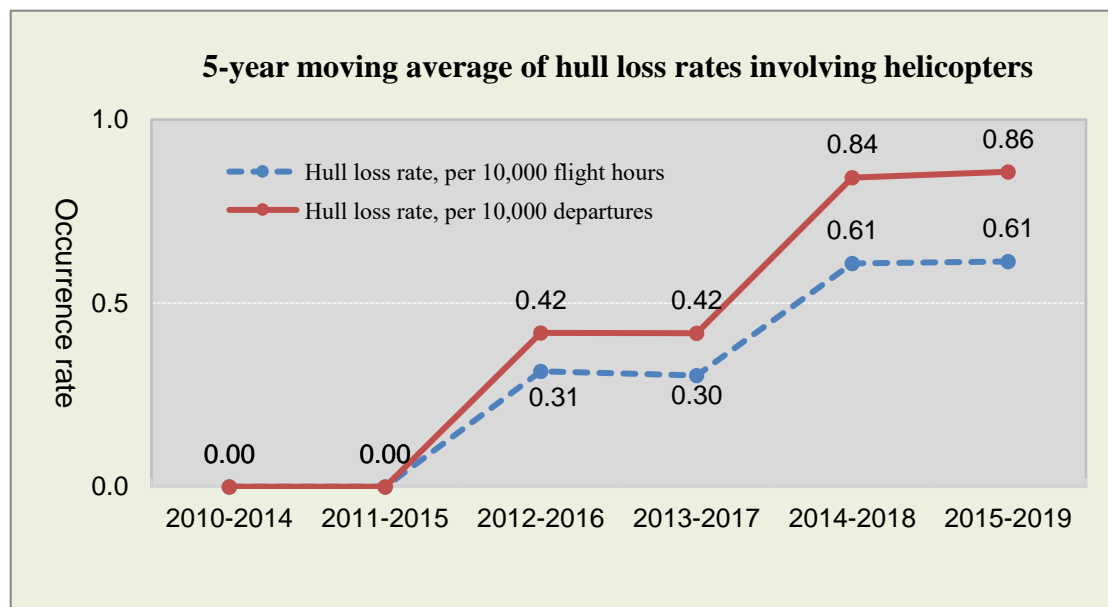


Figure 18 Hull loss rates involving public aircraft

5-year Moving Average of Fatal Occurrence Rates

The 5-year moving averages of the fatal occurrence rate of Taiwan public aircraft for the 2010–2014 and 2011–2015 periods were 0. Since 2016, the moving average has exhibited an upward trend, reaching a peak of 1.23 occurrences per 10,000 flight hours or 1.72 occurrences per 10,000 departures in 2019 (Figure 19). The details are presented in Appendix 9.

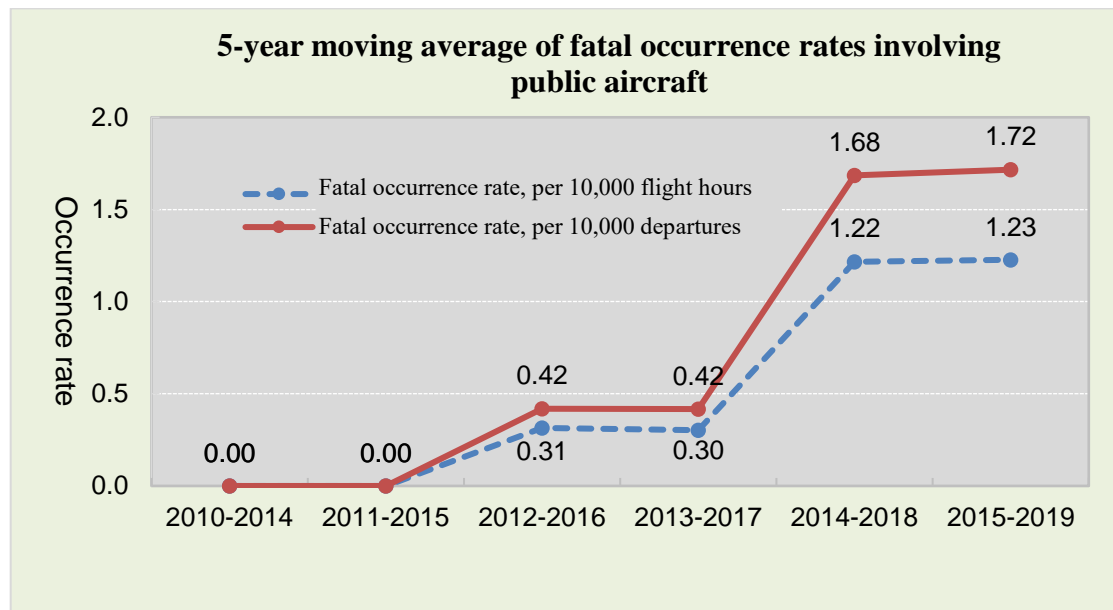


Figure 19 Fatal occurrence rates of public aircraft

2.7 Major Occurrences Involving Ultra-light Vehicles

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

Ultra-light vehicles were involved in one occurrence of hull loss in 2019, which did not result in any fatalities. Over the past 10 years, 13 major aviation occurrences were reported, four of which were fatal occurrences that resulted in five deaths (Figure 20). The details are presented in Appendix 3.

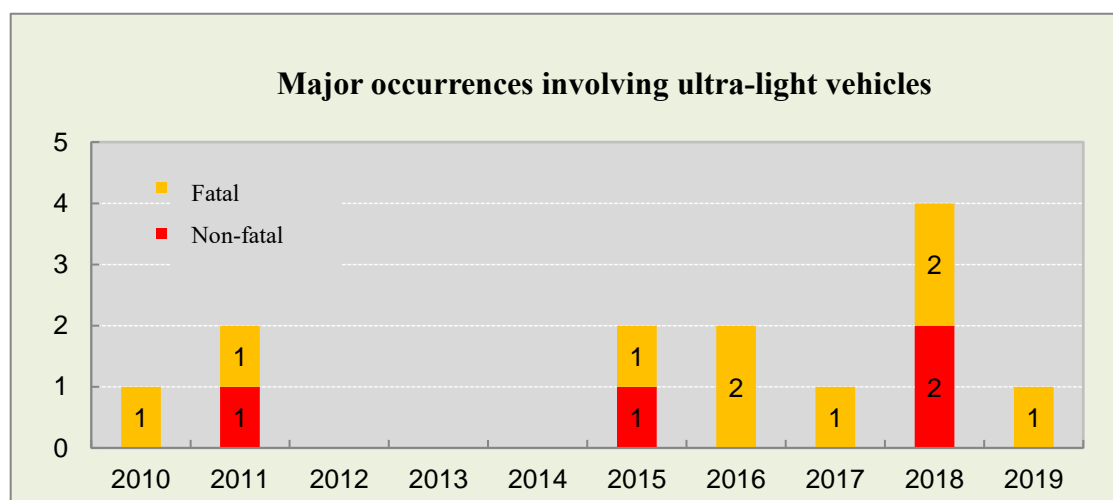


Figure 20 Major occurrences involving ultra-light vehicles

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 cause and to provide appropriate recommendations to prevent similar future occurrences. Since the establishment of our predecessor, the Aviation Safety Council (1998), until the end of 2019, we investigated 128 major aviation occurrences, and in our reports, we provided 1053 recommendations to improve transportation safety.

Government-affiliated agencies received the greatest proportion of the recommendations (558 items; approximately 53.0%), followed by aviation businesses (377 items; approximately 35.8%), and international institutions (118 items; approximately 11.2%).

In terms of operational categories, civil aviation enterprises received the highest proportion of recommendations (634 items; approximately 60.2%), followed by general aviation enterprises (217 items; approximately 20.6%), public aircraft (135 items; 12.8%), and ultra-light vehicles (67 items; 6.4%), as demonstrated in Table 9 and Figure 21.

Table 9 Categorization of historical transportation safety recommendations

Recipient Operational type	Government-affiliated agencies	Airlines	International institutions	Total	Percentage
Civil aviation enterprise	295	232	107	634	60.2%
General aviation enterprise	102	110	5	217	20.6%
Public aircraft	123	8	4	135	12.8%
Ultra-light vehicle	38	27	2	67	6.4%
Total	558	377	118	1,053	
Percentage	53.0%	35.8%	11.2%	100%	100%

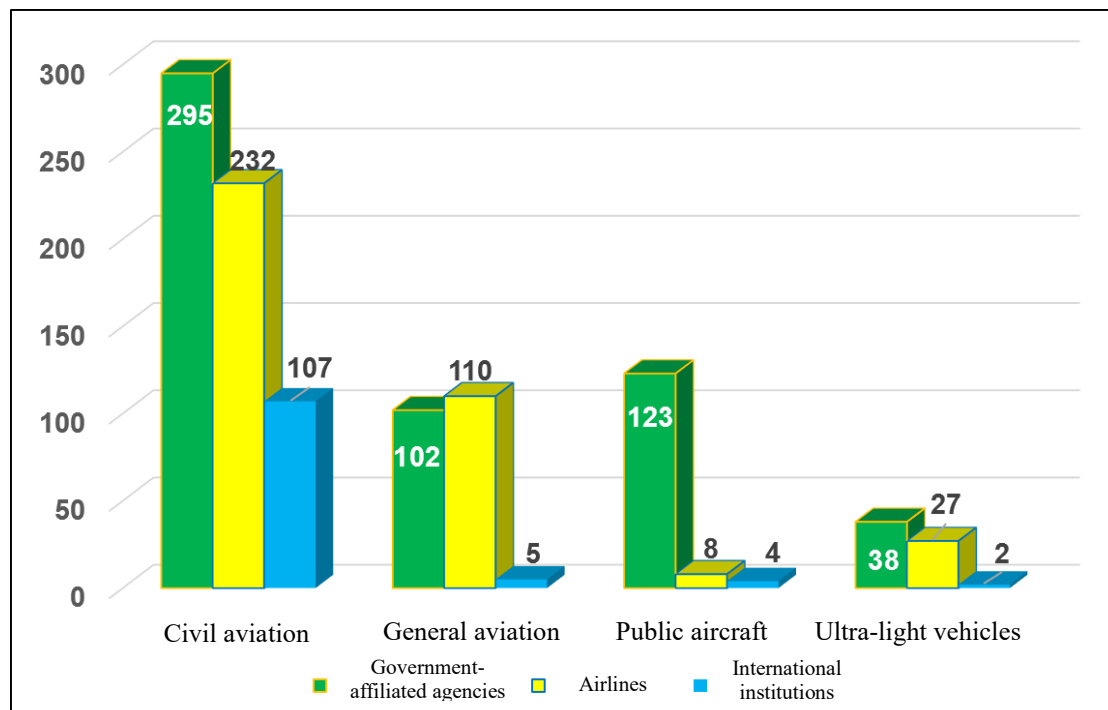


Figure 21 Historical transportation safety recommendations by type

3.2 Implementation Progress of Actions Plans on 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 will be asked to resubmit a plan or supplemental information. If the action plan has a longer schedule or must be completed in stages, it is suggested to be overseen by the Executive Yuan and its status tracked every six months until the improvements are completed and the

case can be closed.

As of December 31, 2019, 15 of the 558 aviation safety recommendations remain under the Executive Yuan's oversight (Table 10). The percentage of concluded recommendations is 97.3%, 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, 2021
2	EVA Air, flight BR 189	Research the feasibility of installing runway centerline lights on runway 10 of Songshan Airport.	March 31, 2020
3	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, 2021
4	SunRise Airlines, flight B-77009	Review the appropriate specifications of each helicopter to ensure the operations of Type A or B airworthy helicopters have concrete plans to follow.	In progress
5-8	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 	<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
		Defense and the CAA (one task per agency, totaling two tasks).	
9	Executive Aviation, flight B-95995	Review the workload of CAA operations inspectors and the effective use of existing personnel.	In progress
10	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, 2020
11	Daily Air, flight DA7507	Review special aerodromes identified as having insufficient runways to lower the 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 crew, and expanding existing runways.	December 31, 2022
12	National Airborne Service Corp, flight NA-302	Evaluate the feasibility of installing flight data recorders or retrofitting simple flight recorders.	In progress
13	Daily Air, flight DA7511	Strengthen airport hazardous risk assessment and control mechanisms and evaluate the priority of airport runway improvement projects. For example, prioritizing the handling of possible hazards caused by non-fragile objects and open trenches in the runway area to increase runway safety as soon as	May 31, 2020

Item	Major aviation occurrence	Overseen transportation (aviation) safety recommendation	Expected time of completion
		possible.	
14	0106 DIY ultra-light vehicle	Reinforce the policing of illegal ultra-light vehicle activities and the provision of counseling regarding legalization; disseminate the process and regulations of obtaining inspection certificate for self-made ultra-light vehicles and provide counseling to individuals or manufacturers who intend to apply for certification.	In progress
15	Daily Air, flight DA7012	Supervise and assist Daily Air with assessing the air-conditioning environment of the flight deck, number of takeoffs and landings and flight hours per day, and human resource management and self-supervision of flight crews.	In progress

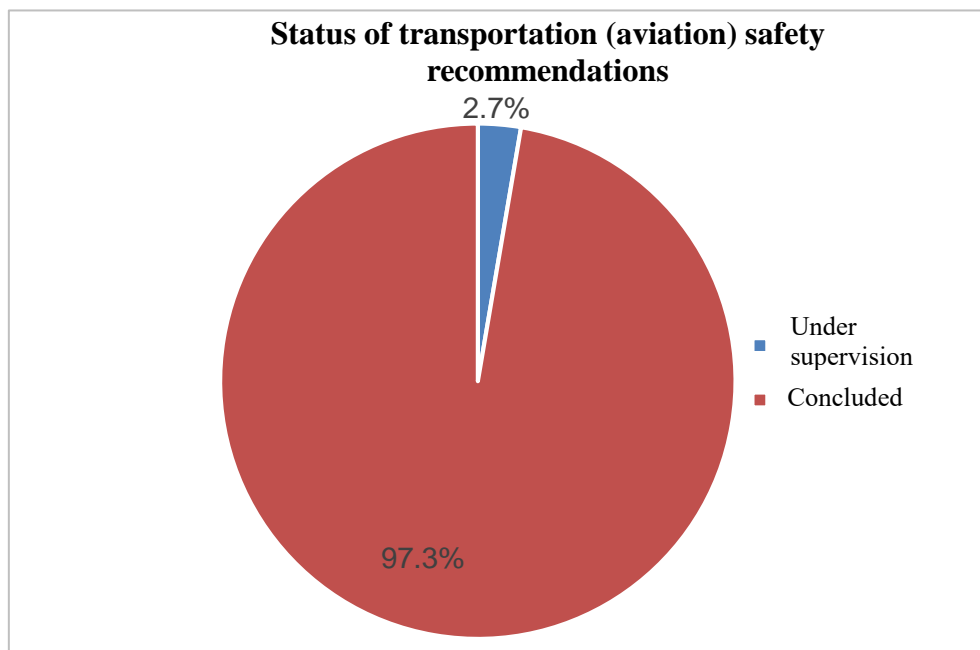


Figure 22 Status of transportation (aviation) safety recommendations

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 that 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: an 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 other aircraft without a human pilot aboard, as announced by the 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 600 kg;
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 222 km/h under standard atmospheric conditions at sea level;
5. A maximum stalling speed, without use of lift-enhancing devices, not exceeding 83 km/h 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 in the case of a powered glider;
7. A fixed-pitch, teetering and semi-rigid two-blade rotor system in the case of a gyroplane;
8. A non-pressurized cabin, if equipped with a cabin; and
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 as a civil air transport enterprise for compensation, including aerial tourism, survey, photographing, firefighting, searching, paramedic, hauling and lifting, spraying and dusting, drone-hauling service, business charter, as well as other authorized aviation services.

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

Aircraft accident: an occurrence associated with the operation of aircraft that 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 that associated with the operation of a drone that 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, 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 that 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 that associated with the operation of a drone that 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, which almost results in an accident.

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, fatalities, or property damage or that have caused social concerns and have been identified by the TTSB.

Major transportation occurrence investigation: a process consisting of transportation (including aviation) 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 compiling submissions from all technical subgroups in accordance with the format administered by the International Civil Aviation Organization and other relevant domestic or 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 perform official duties, excluding military aircraft administered by the Ministry of Defense.

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

Major aviation occurrence: 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: Death of any person in the aircraft, by coming in direct contact with any part of the aircraft or being directly exposed to the airflow caused by the aircraft, and 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. This definition includes those who died on the spot and within 30 days of being injured.

Injury: Injury to any person is in the aircraft, by coming in direct contact with any part of the aircraft or being directly exposed to the airflow caused by the aircraft, and 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, which results in one of the following situations:

1. Hospitalization for more than 48 hours is required within 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. Second- or third-degree burns, or burns covering more than 5% of the skin of the whole body; or
6. Confirmed exposure to contaminated substances or harmful radiation.

Substantial damage: Damage that 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 damage to main rotor blades, tail rotor blades, landing gear, and that resulting from hail or bird strike (including holes in the radome).

Missing: Failure to recover the wreckage of the aircraft at the conclusion of the search efforts, as determined by the TTSB.

Scope of Major Aviation Occurrences¹²

- (A) Civil and public aircraft: 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, that results in any one of the following situations:
1. a person, either within or without the aircraft, is fatally or seriously injured;
 2. the aircraft sustains substantial damage or structural failure, is missing, or completely inaccessible; or
 3. other likelihoods that result in the death, injury, or aircraft incident and deemed necessary to investigate by the TTSB.
- (B) Ultra-light vehicle: 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, that results in any one of the following situations:
1. a person, either within or without the aircraft, is fatally or seriously injured;
 2. the aircraft sustains substantial damage or structural failure, is missing, or completely inaccessible; or
 3. other serious impacts on civilian lives or property and deemed necessary to investigate by the TTSB.
- (C) Drone: an occurrence 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, that results in any one of the following situations:
1. a person, either within or without the aircraft, is fatally or seriously injured;
 2. a drone exceeding the maximum weight of 25 kg sustains substantial damage; or
 3. other serious impacts on civilian lives or property and deemed necessary to investigate by the TTSB.

Definition of Terms Used in 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.

Definition of Terms Used in the Aircraft Flight Operation Regulations

¹² Defined by the TTSB in conjunction with the MOTC, then submitted to the Executive Yuan for approval, effective August 1, 2019

Large aircraft

1. Airplane: an airplane with a maximum certificated takeoff weight of over 5700 kg.
2. Helicopter: A helicopter with a maximum certificated takeoff weight of over 3175 kg.

Small aircraft

1. Airplane: an airplane with a maximum certificated takeoff weight of 5700 kg or less.
2. Helicopter: a helicopter with a maximum certificated takeoff weight 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 that is moored to the surface of the earth or an object.

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 accident 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 Category¹³

- 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)

¹³ As of 2018, occurrence categories refer to the 2017 version, not the 2004 version.

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

Other Terms and Definitions

Free balloon¹⁴: A non-power-driven, lighter-than-air passenger aircraft, including

¹⁴ Free balloon Q&A, CAA Flight Standards Division

inflatable free balloons and hot air balloons; hot air balloons are a type of free balloon.

Hot air balloon¹⁵: A non-power-driven lighter-than-air aircraft that is buoyed by hot air and must have been inspected and issued a Certificate of Airworthiness by the CAA before taking flight.

¹⁵ Civil Aviation Notice AC91-005D “Hot-air balloon passenger flight activities or tethered operations,” CAA Flight Standards Division

Appendix 1 Operational overview and indicators of Taiwan national airlines

Time		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Taiwan national airlines	Number of airlines	13	13	15	15	18	18	18	16	15	17	
	Civil aviation enterprises	8	8	8	8	10	9	9	8	8	9	
	General aviation enterprises	7	7	9	9	11	11	11	10	10	11	
	Number of airworthy aircraft	182	199	210	234	249	255	260	263	274	278	
Civil aviation services	Passenger count	Domestic routes	4,824,917	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
		International routes	20,603,129	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
		Total	25,428,046	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
	Cargo weight in tons	Domestic routes	50,981	51,462	49,034	45,651	37,318	39,941	40,491	34,498	35,407	43,009
		International routes	1,868,875	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
		Total	1,919,856	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
	Number of flights	Domestic routes	83,019	87,703	84,933	87,939	89,316	84,455	87,257	79,638	90,731	98,887
		International routes	119,982	121,989	132,913	144,135	156,985	168,089	178,842	168,158	175,390	174,695
		Total	203,001	209,692	217,846	232,074	246,301	252,544	266,099	247,796	266,121	273,582
	Passenger helicopters	Flight hours	244.93	231.7	142.85	87.6*	167.2	137.8	148.1	211.3	193.3	122.1
		Number of flights	484	67	364	184*	440	383	468	646	246	102
		Passenger count	2,517	698	1,573	972*	2,010	1,852	2,287	3,204	2,735	1,009
General aviation	Flight hours	4,507.7	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	
Taiwan national helicopters	Flight hours	2,926	3,230	3,084	2,090	1,935	1,317	1,675	1,587	1,058	1,347	
	Number of flights	973	2,502	2,276	1,842	1,379	1,134	1,152	1,463	1,147	979	

* 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 in 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 enterprises.

Appendix 2 National Airborne Service Corps flights and aircraft

Year	Mission type	Total number of flights	Total flight hours	Aircraft type/inventory count			
2010	Air disaster relief Air search and rescue Air emergency medical services Air reconnaissance and patrol Air transportation	6,409	7,945:57	AS-365	10	BE-200	1
				BE-350	1	S-76B	2
				B-234	2	UH-1H	15
2011		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			

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, National Airborne Service Corps, established March 10, 2004, and formalized 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 aviation enterprises

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Occurrence category	Occurrence cause	Report title
1	2010.03.04	China Airlines	B747-400F	B-18723	CI5233	Substantial damage	0	0	Take off	ARC	Pilot	Belly landing on the Anchorage International Airport runway during the takeoff phase
2	2010.07.22	China Airlines	B737-800	B-18612	CI112	None	0	0	En route	SCF-NP	System and equipment	Emergency descent and return after cabin pressure failure while climbing
3	2010.09.02	EVA Air	B747-400	B-16410	BR701	Damage	0	0	Landing	RE	Pilot, weather	Brief runway excursion while landing at Taoyuan International Airport
4	2010.12.29	EVA Air	A330-300	B-16312	BR61	None	0	0	En route	SCF-NP	System and equipment	Two air supply systems malfunctioning while en route, leading to abnormal cabin pressure and emergency use of oxygen by the cabin crew
5	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
6	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
7	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
8	2012.03.25	EVA Air	B747-400	B-16411	BR702	None	0	0	En route	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
9	2012.05.02	TransAsia Airways	ATR72-500	B-22810	GE515	Substantial damage	0	0	En route	SCF-PP	Engine	Fire alarm in the left engine during the climbing process
10	2012.05.16	Far Eastern	MD-82	B-28037	FE025	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Penghu Airport

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Occurrence category	Occurrence cause	Report title
		Air Transport										
11	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
12	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
13	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
14	2012.08.24	China Airlines	A330-300	B-18353	CI947	None	0	0	En route	SCF-NP	System and equipment, pilot, other persons, upkeep	Emergency descent after encountering abnormal cabin pressure while en route 155 nautical miles northeast of Hong Kong
15	2012.09.13	EVA Air	A330-300	B-16331	BR189	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Songshan Airport
16	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
17	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
18	2013.06.03	China Airlines	A330-300	B-18317	CI781	None	0	0	En route	SCF-NP	System and equipment	Emergency descent after encountering abnormal cabin pressure 110 nautical miles northeast of Ho Chi Minh City
19	2013.07.01	TransAsia	ATR72-500	B-22806	GE5111	None	0	0	En route	SCF-NP, F-NI	System and	Presence of hot gas in the flight deck during takeoff and

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Occurrence category	Occurrence cause	Report title
		Airways									equipment, pilot	climbing while departing from Songshan Airport
20	2013.09.08	China Airlines	B747-400F	B-18716	CI5621	None	0	0	En route	SCF-NP	Other persons, upkeep, system and maintenance	Emergency descent after encountering abnormal cabin pressure en route 41 nautical miles southwest of Penghu Airport
21	2013.10.03	China Airlines	A330-300	B-18358	CI052	None	0	0	En route	SCF-PP	Engine	While en route, 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
22	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
23	2014.04.11	China Airlines	B737-800	B-18601	CI7916	None	0	0	En route	SCF-NP, F-NI	System and equipment	Electric arcs and smoke appeared in the passenger cabin ceiling approximately 500 km northwest of Suvarnabhumi Airport
24	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
25	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
26	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	Occurrence category	Occurrence cause	Report title
27	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
28	2015.02.04	TransAsia Air Transport	ATR72-600	B-22816	GE235	Hull loss	43	14	En route	SCF-NP, LOC-I	Pilot, system and equipment	Loss of control 3 nautical miles east of Songshan Airport and crashing into Keelung River
29	2015.02.05	Daily Air	DO-228	B-55565	DA7507	None	0	0	Landing	RE	Pilot, weather	Runway excursion while landing at Lanyu Airport
30	2016.04.17	China Airlines	B737-800	B-18609	CI025	None	0	0	En route	SCF-PP	System and equipment	Turning back because of abnormal cabin pressure approximately 150 nautical miles northwest of Guam
31	2016.05.06	V Air	A321-200	B-22610	ZV252	None	0	0	En route	OTHER, F-NI	Other	Fire and smoke from a passenger's power bank while en route
32	2016.07.24	TransAsia Air Transport	A320-200	B-22317	GE367	None	0	0	En route	SCF-NP, F-NI	System and equipment	Smoke from the water heater in the galley behind the passenger cabin while climbing
33	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
34	2016.12.07	China Airlines	B737-800	B-18605	CI027	None	0	0	En route	OTHER, F-NI	Other	Smoke from a passenger's cell phone during the en route phase
35	2016.12.16	EVA Air	B777-300ER	B-16726	BR015	None	0	0	En route	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
36	2017.04.13	Daily Air	DHC-6-400	B-55571	DA7511	Substantial	0	0	Landing	RE	Pilot, weather, airport	Substantial damage to the aircraft due to a runway excursion while landing on runway 13 of Lanyu Airport

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Occurrence category	Occurrence cause	Report title
						damage					facility	
37	2017.11.22	EVA Air	B777-300ER	B-16718	BR56	None	0	2	En route	TURB	Weather, other persons – passenger	Strong turbulence while en route 42 nautical miles northeast of Miyazaki Airport
38	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
39	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
40	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
41	2018.07.02	Far Eastern Air Transport	MD-82	B-28035	FE8026	Light damage	0	0	En route	SCF-PP	Engine	Left engine malfunctioning approximately 10 nautical miles from Songshan Airport while on approach
42	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
43	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
44	2018.10.19	China Airlines	B747-400F	B-18719	CI5880	None	0	0	Standing	SCF-NP	System and equipment, other	Tire explosion when performing tire pressurization at Singapore Changi Airport

Order	Date	Airline	Aircraft model	Registration number	Flight number	Damage to aircraft	Fatalities	Serious injuries	Flight phase	Occurrence category	Occurrence cause	Report title
											persons, ground handling	
45	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
46	2018.12.22	EVA Air	B777-300ER	B-16716	BR61	None	0	0	En route	ATM	Pending	Approaching flights NCR840 and KLM875 while in airspace under control of Delhi, India
47	2019.03.09	China Airlines	B747-400	B-18211	CI122	None	0	0	En route	FUEL	Pilot	Fuel distress occurring prior to landing at Taoyuan International Airport
48	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
49	2019.05.02	Mandarin Airlines	ATR72-600	B-16851	AE7931	None	0	0	En route	SCF-NP	System and equipment	Temporary loss of pressure in the passenger cabin during the descent
50	2019.05.30	China Airlines	A330-300	B-18352	CI922	None	0	0	En route	SCF-PP, F-NI	Pending	Engine fire alarm at cruising level 250 after departing Hong Kong International Airport and returning to Hong Kong

General Aviation Enterprises

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 Industrial Development Corporation	Astra-SPX	B-20001	Tow target	None	0	0	Brief runway excursion while landing at Taichung International Airport

National helicopters

Order	Date	Airline	Aircraft model	Registration number	Operation	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	Evacuation of the injured	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

Ultra-light vehicles

Order	Date	Activity Group	Aircraft model	Registration number	Aircraft damage	Fatalities	Serious injuries
1	2010.03.20	None	N/A	None	Hull loss	0	1
2	2011.03.06	None	Quick Silver GT 400	None	Hull loss	0	1
3	2011.09.21	None	Storch	None	Hull loss	1	0
4	2015.03.16	Taiwan Ultra-Light Flights Development Association	RANS S-6 COYOTE II	PA-2002	Hull loss	2	0
5	2015.06.21	Taiwan Aviators Sports Association	HAWK ARROW II	None	Hull loss	0	1
6	2016.02.20	None	Super Bingo	None	Hull loss	0	0
7	2016.11.17	KaiXiang Aerosports Association	Remos GX	AJ-2666	Hull loss	0	1
8	2017.03.11	None	Storch	None	Hull loss	0	1
9	2018.01.06	None	N/A	None	Hull loss	0	0
10	2018.07.08	None	Skylark IIS	None	Hull loss	0	2
11	2018.09.02	None	N/A	None	Hull loss	1	0
12	2018.09.14	Chinese Taipei Powered Paragliding Association	LIFT M	PM-1052	Hull loss	1	0
13	2019.01.27	None	APCO LIFT EZ S	None	Hull loss	0	1

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

Year	Global (IATA)					Taiwan				
	Departures	Hull loss	Hull loss rate	Fatal occurrences	Fatal occurrence rate	Departures	Hull loss	Hull loss rate	Fatal occurrences	Fatal occurrence rate
	Million	Occurrences	Per million departures	Occurrences	Per million departures	Occurrences	Occurrences	Per million departures	Occurrences	Per million departures
2010	28.42	21	0.74	N/A	N/A	150,402	0	0.00	0	0.00
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
2010-2014	148.10	64	0.43	N/A	0.23	868,800	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	0.08	986,688	0	0.00	0	0.00
2014-2018	168.50	41	0.24	15	0.08	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

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

Year	Global (IATA)					Taiwan				
	Departures	Hull loss	Hull loss rate	Fatal occurrences	Fatal occurrence rate	Departures	Hull loss	Hull loss rate	Fatal occurrences	Fatal occurrence rate
	Million	Occurrences	Per million departures	Occurrences	Per million departures	Occurrences	Occurrences	Per million departures	Occurrences	Per million departures
2010	8.35	22	2.63	N/A	N/A	58,159	0	0.00	0	0.00
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
2010-2014	38.82	106	2.73	N/A	1.86	317,395	1	3.15	1	3.15
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	0.92	316,278	2	6.32	2	6.32
2014-2018	35.90	47	1.31	28	0.79	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
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Appendix 6 ICAO and Taiwan statistics on civil aviation accidents

Year	ICAO	Taiwan		
	Accident occurrence rate	Departures	Accidents	Accident occurrence rate
	Per million departures	Occurrences	Occurrences	Per million departures
2010	4.20	208,561	1	4.79
2011	4.20	241,683	0	0.00
2012	3.20	229,021	2	8.73
2013	2.90	245,133	0	0.00
2014	3.00	261,797	1	3.82
2015	2.80	262,999	1	3.80
2016	2.10	275,241	1	3.63
2017	2.40	257,796	3	11.64
2018	2.60	278,931	0	0.00
2019	Incomplete	284,895	0	0.00

Appendix 7 Hull loss and fatal occurrence rates in Taiwan's general aviation industry

Year	Flight time	Hull loss	Hull loss occurrence rate	Fatal occurrences	Fatal occurrence rate
	Hours	Occurrences	Per 10,000 flight hours	Occurrences	Per 10,000 flight hours
2010	4,508	0	0.00	0	0.00
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
2010-2014	19,168	2	1.04	2	1.04
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

Appendix 8 Hull loss and fatal occurrence rates involving helicopters

Year	Flight time	Departures	Hull loss	Hull loss occurrence rate		Fatal occurrences	Fatal occurrence rate	
	Hours	Occurrences	Occurrences	Per 10,000 flight hours	Per 10,000 Departures	Occurrences	Per 10,000 flight hours	Per 10,000 Departures
2010	2,926	973	0	0.00	0.00	0	0.00	0.00
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
2010-2014	13,265	8,972	1	0.75	1.11	1	0.75	1.11
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

Appendix 9 Fatal occurrence rates of public aircraft

Year	Flight time	Departures	Hull loss	Hull loss occurrence rate		Fatal occurrences	Fatal occurrence rate	
	Hours	Occurrences	Occurrences	Per 10,000 flight hours	Per 10,000 Departures	Occurrences	Per 10,000 flight hours	Per 10,000 Departures
2010	7,946.0	6,409	0	0.00	0.00	0	0.00	0.00
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
2010-2014	33,406	25,513	0	0.00	0.00	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