BY RICK DARBY

Zero Gained

Taiwan's commercial transport category airplanes have had no fatal accidents since 2002.

Taiwan's civil aviation accident record for transport category airplanes over the 2000–2009 period shows a single fatal accident each in the commercial jet and turboprop categories. Of 34 occurrences[1] — accidents and incidents — during the 10 years, the largest number happened in the landing phase of flight. But the two occurrences in the most serious class took place en route. The data were released in a report by the Taiwan Aviation Safety Council (ASC), the official accident investigation body.[2]

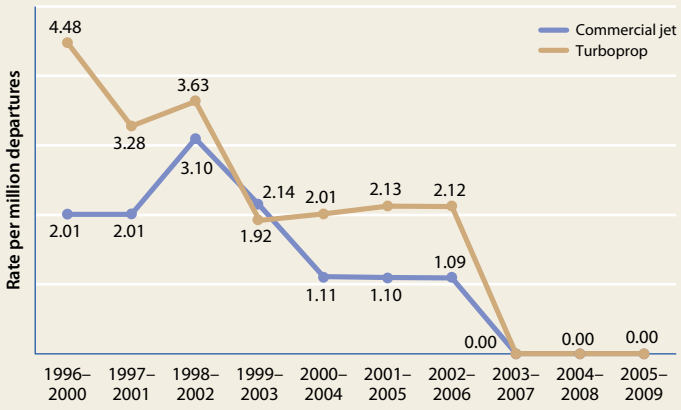
The fatal accident in commercial jet operations was in 2002, and the 2000–2009 fatal accident rate was 0.61 per million departures. For turboprops, the fatal accident also occurred in 2002, and the 10-year fatal accident rate was 1.02 per million departures.[3]

Based on five-year moving averages[4] going back to 1996, the fatal accident rate per million departures has shown improvement except for a spike in the 1998–2002 period (Figure 1). Before 2003–2007, the rates for turboprops were almost always higher than for commercial jets. From then on, the moving average has held steady at 0.0 for both airplane classifications.

The ASC also calculated hull loss occurrence five-year moving averages. In contrast with fatal occurrences, the hull loss rates for commercial jets were higher than for turboprops beginning with 1999–2003. "The difference suggested that there were some cases where commercial jet airplanes' … occurrences resulted in hull loss, but without fatalities," the report says. In 2009, turboprops completed their third straight five-year period with a moving average of zero hull losses.

According to the accident definition of the International Civil Aviation Organization (ICAO), there were 16 transport category

Taiwan Fatal Occurrence Rates, by Million Departures, 2000–2009



Note: Data points represent five-year moving averages.

Source: Taiwan Aviation Safety Council

Figure 1

airplane accidents in Taiwan over 10 years (Figure 2). Of the total, 13 involved commercial jets, and three involved turboprops. The 10-year rate was 6.1 accidents per million departures.

"Most of the occurrences during [the 2000–2009] period resulted in serious injuries without aircraft damage [or] substantial damage only," the report says, with those two categories accounting for 12 of the 16 accidents.

The ASC devised its own classifications for occurrences because, the report says, "accidents as defined by ICAO might be classified into [the] same category with significantly different levels of severity."

The ASC placed each occurrence into one of six classes. Those concerning transport category airplanes include the following:

- Class I: "An occurrence of an airplane not of a general aviation nature, which resulted in fatality or injury and the airplane was substantially damaged."
- Class II: "An occurrence of an airplane not of a general aviation nature, which resulted in fatality or injury but the aircraft was not substantially damaged."
- Class III: "An occurrence of an airplane not of a general aviation nature, which did not result in fatality or injury but resulted in substantial damage to the aircraft."
- Class V: "Serious incidents of all types of aircraft except ultralight vehicles."[5]

Commercial transport category jets had, over the 10-year period, a rate of 0.20 occurrences per million flight hours for class I, 1.19 for both class II and class III and 2.78 for class V. There was a single occurrence in class I, six each in class II and class III, and 14 in class V.

Comparable figures for commercial transport category turboprops during the 10-year stretch were 1.09 occurrences per million flight hours for class I, 0.00 for class II, 2.18 for class III and 4.35 for class V.

Overall, for 2000–2009, the class I occurrence rate for turboprops was 5.5 times that for jets.

Taiwan Accidents, Transport Category Airplanes, by Phase of Flight, 2000–2009

Note: Accident definitions match those of the International Civil Aviation Organization.

Source: Taiwan Aviation Safety Council

Figure 2

Five-year moving average rates for class I occurrences decreased over the years 2000–2006 for transport category airplanes, based on occurrences per million flight hours. "The moving average for class I occurrences decreased year over year since 2002 and achieved the zero-accident rate per million hours flown by 2007," the report says. "The numbers of class II occurrences had always been low until an increasing trend began in 2005. In 2005, there were two occurrences of clear air turbulence resulting in injuries and in 2006 there was a midair collision, together causing the upward trend. The trend continued to 2008 because of two occurrences related to turbulence.

"The trend for occurrences in class III increased gradually over the years and did not seem to go down significantly in the recent five years. For occurrences in class V, the occurrence was at its highest in 2003, resulting in 4.2 per million flight hours, but the rate gradually decreased to 1.81 per million flight hours and remained [near that level] to 2009."

In terms of occurrences per million departures, the trend was nearly the same (Figure 3, p. 50).

The report added the proviso, however, that "prior to 1998, documented statistics were limited, only aviation accidents would be recorded and serious incidents were not officially recorded. … Therefore, the average occurrence rate in class V was more reliable since the interval of 1999–2003."

In total, for the 2000–2009 years, class I occurrences were 6 percent of the total, class II 18 percent, class III 23 percent and class V 53 percent.

The ASC looked at the 34 occurrences according to phase of flight as defined by the U.S. Commercial Aviation Safety Team (CAST)-ICAO (Figure 4). Fifteen, or 44 percent, took place during the landing phase. Eight were en route, including two class I, five class II and one class V occurrences.

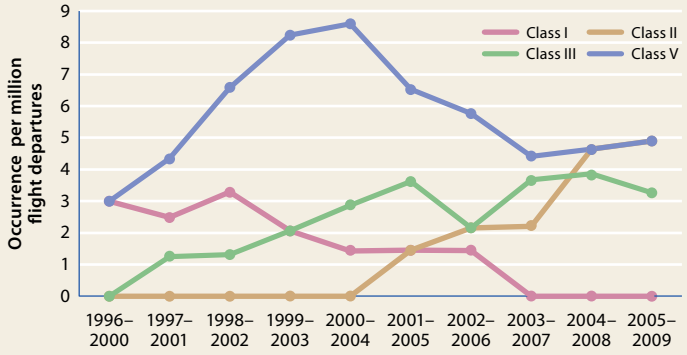
Occurrences were categorized according to CAST-ICAO taxonomy (Figure 5).[6] Runway excursions were the most frequent, totaling nine, or slightly above one-quarter of the total. Next most common were the five instances of abnormal runway contact, 15 percent of all the occurrences.

The report says, "When further analyzed [by] ASC classification, the most frequent class I occurrences were SCE-NP [system/component failure or malfunction, non-powerplant] and ICE [icing]. Although the highest numbers of occurrences came from the category of RE [runway excursions], eight of the nine cases were class V."

Following what it says is U.S. National Transportation Safety Board practice, the ASC sliced the data yet a third way, using the broad categories of personnel, environment and aircraft.[7] Among the 34 occurrences, the investigations of 29 had reached closure. At least one of the broad categories was implicated in each, and in some cases, more than one was cited.

"For most of the 10-year period, personnel were cited as a cause or factor in 89.7 percent [of occurrences], followed by 34.5 percent of environment-related causes/factors and by 17.2 percent of aircraft-related causes/factors. … The pilot was responsible in 62.1 percent of occurrences where personnel was the cause or factor."

Taiwan Occurrence Rates, Transport Category Airplanes, by Class, 2000–2009

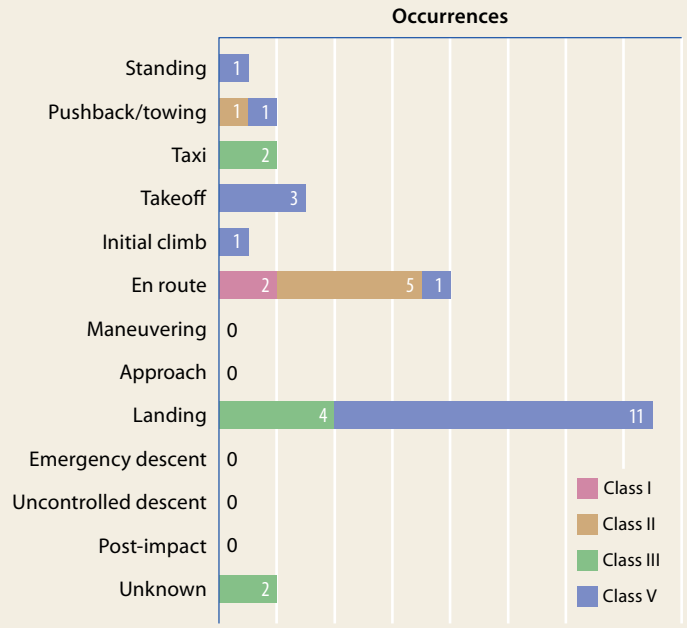


Note: Data points represent five-year moving averages. Classes are determined by the Taiwan Aviation Safety Council. For definitions, see p. 49.

Source: Taiwan Aviation Safety Council

Figure 3

Taiwan Occurrences, Transport Category Jet and Turboprop Airplanes, by Phase of Flight, 2000–2009



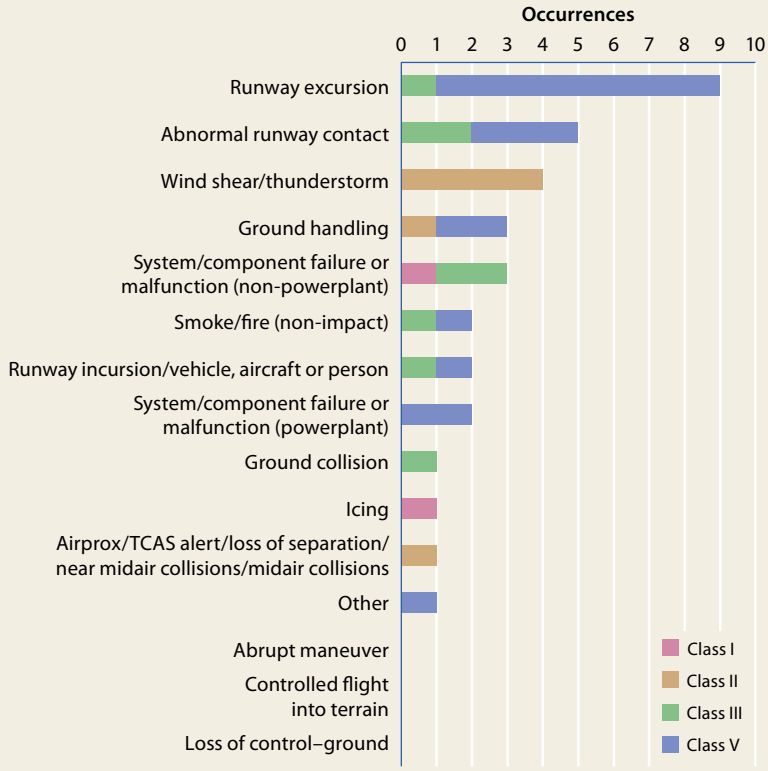
Note: Phases of flight match U.S. Commercial Aviation Safety Team–International Civil Aviation Organization definitions. Classes are determined by the Taiwan Aviation Safety Council. For definitions, see p. 49.

Source: Taiwan Aviation Safety Council

Figure 4

Pilot, other personnel, weather and structure were each cited in 3.4 percent of class I occurrences involving transport category airplanes.

Taiwan Occurrences, Transport Category Airplanes, by Causal Factors, 2000–2009



TCAS = Traffic-alert and collision avoidance system

Note: Phases of flight match U.S. Commercial Aviation Safety Team–International Civil Aviation Organization definitions. Classes are determined by the Taiwan Aviation Safety Council. For definitions, see p. 49.

Source: Taiwan Aviation Safety Council

Figure 5

Among all occurrences, pilots were a cause or factor in 62 percent. Weather was a cause or factor in 30.9 percent of occurrences.

The report combines data for general aviation (GA) and helicopters, while noting that in Taiwan, "the majority of [GA] is carried out by helicopter, with the exception of a few turboprop airplanes." GA includes "service aircraft (fixed-wing and rotor aircraft) and helicopters (transport category)."

Over the 2000–2009 period, there were two fatal GA/helicopter accidents and an overall accident rate of 8.96 per 100,000 flight hours.

The report says that the ASC made 465 aviation safety recommendations from April 1999 to June 2010 — about half to Taiwanese government agencies, a third to the aviation industry and the rest to non-Taiwanese organizations. Of the 236 recommendations to government agencies leading to action plans, 235 have been accepted, the report says.

Notes

1. The ASC defines an *occurrence* as "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: (1) a person sustains death or serious injuries; (2) the aircraft sustains substantial damage or [is] missing; or (3) death or serious injuries of a person or substantial damage of the aircraft nearly occurred."

   This differs from the ICAO definition of an *accident*, which adds, "Death or serious injury results from being in the airplane; or direct contact with the airplane or anything attached thereto; or direct exposure to jet blast." The ICAO accident definition does not include events that "nearly occurred."

2. The study is available on the Internet at <www.asc.gov.tw/author_files/statistics00-09_Eng.pdf>. Sources of the ASC data include the Taiwan Civil Aeronautics Administration and the ASC's own occurrence investigation reports.

3. Turboprop airplanes for which data were included in the study were the Avions de Transport Régional ATR 72, Fokker F-50, Dornier Do-228, de Havilland DH-8 and Saab 340.

4. A moving average shows average values over a set period, in this case five years. The purpose of a moving average is to make trends clearer by smoothing out short-term fluctuations.

5. Class IV, omitted in the figures, refers to helicopters, general aviation or public aircraft.

6. A list of the categories and abbreviations is available at <www.intlaviationstandards.org/acronyms.html>.

7. "Personnel classification included pilot and other personnel such as maintenance personnel, air traffic controller and management personnel," the report says. "Environmental categories included those causes related to weather, airport facilities, air traffic facilities, time of the accident (day or night), light conditions and terrain conditions. In the category of aircraft-related causes or factors were failures of aircraft systems and equipment, engines and structure or performance of the aircraft."