Unsafe Acts

A study finds more similarities than differences in error patterns among crewmembers on accident aircraft in Australia and the United States.

BY LINDA WERFELMAN

A study of errors by flight crewmembers involved in aviation accidents in Australia and the United States found that the patterns of errors were "remarkably similar" and that skill-based errors — such as omitting a checklist item or fixating on a task — were the most common.[1]

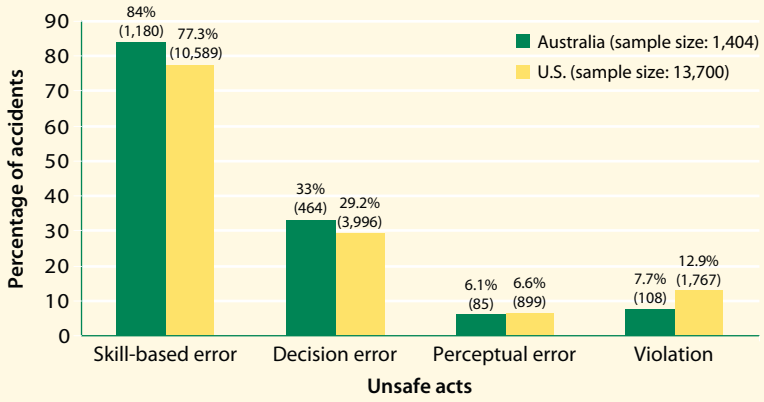
"The rationale behind comparing Australian and U.S. data is to discover whether there are similar trends in involvement of human factors in aviation accidents," said a report on the study by the Australian Transport Safety Bureau (ATSB). "If this is the case, it may be reasonable to assume that solutions to common problems developed in one country will be transferable to the other."

The study used the human factors analysis and classification system (HFACS) to examine and classify data from aircraft accidents that occurred during the 10-year period beginning in 1993. During that period, 69 percent of accidents in Australia and 72 percent of accidents in the United States involved at least one unsafe act by flight crewmembers, the report said (Figure 1).

The report said that "unsafe acts" include errors in doing, thinking and perceiving — known, respectively, as skill-based errors, decision errors and perceptual errors. Unsafe acts also include two types of violation, defined in the report as "a deliberate breach of the rules by an operator who knows they are breaking air law" — routine, small-scale violations and "exceptional" violations that deviate significantly from the rules.

For example, the report said skill-based errors recorded in Australian accidents included "landing errors, including problems with flare, alignment, touchdown point, descent rate and distance/altitude and speed; not maintaining

Percentage of Accidents Associated With Each Unsafe Act



Source: Australian Transport Safety Bureau

Figure 1

physical clearance or visual lookout; losing directional control on the ground; and not maintaining airspeed."

Decision errors included "selecting unsuitable terrain for landing/takeoff/taxiing, improper preflight planning; poor in-flight planning or decision, and performing a low-altitude flight maneuver," the report said.

The report cited perceptual errors such as "misjudging physical clearance, losing aircraft control, problems with visual/aural perception, and misjudging altitude/distance/speed."

The report also identified several violations: "not following procedures or directives (standard operating procedures), visual flight rules into instrument meteorological conditions, operating an aircraft without proper endorsement or certification [or] … outside its weight and balance limits, and performing low-altitude flight maneuvers."

A higher proportion of Australian accidents were associated with skill-based errors. A greater proportion of U.S. accidents involved violations. There were no significant differences between the proportions of Australian and U.S. accidents associated with decision errors or perceptual errors.

The examination of the distribution of errors by flight crewmembers found "an unexpectedly large number of errors and violations in Australian on-demand/commuter operations," the report said (Table 1). On-demand/commuter operations accounted for 26.9 percent of all violations in Australian accidents, 21.2 percent of perceptual errors, 20.4 percent of decision errors and 11.8 percent of skill-based errors.

By comparison, in the United States, on-demand/commuter operators accounted for between 3.5 percent and 8.7 percent of violations and errors (Table 2).

In both countries, general aviation accounted for the vast majority of errors and violations.

The study found that, of accidents involving at least one unsafe act, 11 percent of

Unsafe Acts Grouped by Type of Flight Operation, Australian Accidents

Flying Operation (Regulation Part)	Skill-based Error	Decision Error	Perceptual Error	Violation
General aviation (Part 91)	861 (73%)	298 (64.2%)	51 (60%)	73 (67.6%)
Air carrier (Part 121)	2 (0.2%)	1 (0.2%)	1 (1.2%)	1 (0.9%)
Large civil aircraft (Part 125)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rotorcraft with external load (Part 133)	2 (0.2%)	3 (0.6%)	0 (0%)	2 (1.9%)
On-demand and commuter (Part 135)	139 (11.8%)	95 (20.4%)	18 (21.2%)	29 (26.9%)
Agricultural (Part 137)	162 (13.7%)	58 (12.5%)	13 (15.3%)	2 (1.9%)
Public use	14 (1.2%)	9 (1.9%)	2 (2.4%)	1 (0.9%)
Total	**1,180**	**464**	**85**	**108**

Source: Australian Transport Safety Bureau

Table 1

Unsafe Acts Grouped by Type of Flight Operation, U.S. Accidents

Flying Operation (Regulation Part)	Skill-based Error	Decision Error	Perceptual Error	Violation
General aviation (Part 91)	9,485 (89.6%)	3,542 (88.6%)	815 (90.7%)	1,530 (86.6%)
Air carrier (Part 121)	63 (0.6%)	52 (1.3%)	6 (0.7%)	19 (1.1%)
Large civil aircraft (Part 125)	1 (0%)	0 (0%)	1 (0.1%)	0 (0%)
Rotorcraft with external load (Part 133)	32 (0.3%)	18 (0.5%)	1 (0.1%)	8 (0.5%)
On-demand and commuter (Part 135)	369 (3.5%)	224 (5.6%)	38 (4.2%)	153 (8.7%)
Agricultural (Part 137)	593 (5.6%)	143 (3.6%)	34 (3.8%)	50 (2.8%)
Public use	46 (0.4%)	17 (0.4%)	4 (0.4%)	7 (0.4%)
Total	**10,589**	**3,996**	**899**	**1,767**

Source: Australian Transport Safety Bureau

Table 2

Comparison of Australian and U.S. Fatal Accidents by Unsafe Act

Unsafe Act	Australia	U.S.	Percent Difference	Lower 99% Confidence Interval	Upper 99% Confidence Interval
Skill–based error	120 (76.9)	2,201 (75.6)	1	–8	10
Decision error	67 (42.9)	850 (29.3)	14	3	24*
Perceptual error	21 (13.5)	249 (8.6)	5	–2	12
Violation	50 (32.1)	826 (28.4)	4	–6	14
Total	**156**	**2,912**			

*Denotes a statistically significant difference

Source: Australian Transport Safety Bureau

Table 3

Comparison of Australian and U.S. Non-Fatal Accidents by Unsafe Act

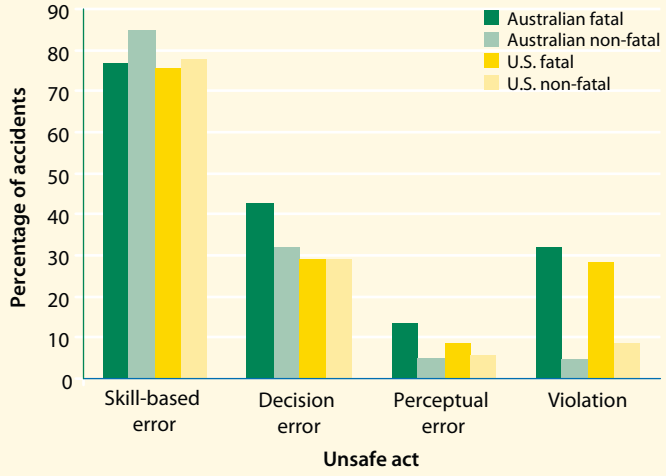
Unsafe Act	Australia	U.S.	Percentage Difference	Lower 99% Confidence Interval	Upper 99% Confidence Interval
Skill-based error	1060 (84.9)	8388 (77.8)	7	4	10
Decision error	397 (31.8)	3146 (29.2)	3	–1	6
Perceptual error	64 (5.1)	650 (6.0)	–1	–3	1
Violation	58 (4.6)	941 (8.7)	–4	–6	–2*
Total	**1,248**	**10,788**			

*Denotes a statistically significant difference

Source: Australian Transport Safety Bureau

Table 4

Comparison Of Australian and U.S. Fatal and Non-Fatal Accidents



Source: Australian Transport Safety Bureau

Figure 2

Australian accidents and 21 percent of U.S. accidents resulted in a fatality. Table 3 shows that the only statistically significant difference between fatal accidents in the two countries was that a greater percentage of Australian fatal accidents were associated with decision errors.

Table 4 and Figure 2 show that a higher percentage of nonfatal accidents in Australia were associated with skill-based errors, when compared with nonfatal U.S. accidents, and fewer nonfatal accidents in Australia were associated with violations.●

Note

1. Australian Transport Safety Bureau (ATSB). *Human Factors Analysis of Australian Aviation Accidents and Comparison With the United States*, Report no. 2004/0321. 2007.