Lack of Available Safety Equipment Faulted in Accidents

A U.K. CAA worldwide fatal accident review finds that after safety equipment, poor visibility ranked second among circumstantial factors.

BY RICK DARBY

The failure to install available safety equipment ranked highest among circumstantial factors in fatal accidents involving civil jet and turboprop airplanes worldwide from 1997 to 2006, the U.K. Civil Aviation Authority (CAA) says.[1]

"Poor visibility or lack of external visual reference" closely followed, and "failure in CRM [crew resource management]" was ranked third.

A circumstantial factor is "an event or aspect which was not directly in the causal chain of events but could have contributed to the fatal accident," the CAA's "Global Fatal Accident Review" says. "A fatal accident may have been allocated any number of circumstantial factors in any combination."[2]

Of the 283 fatal accidents analyzed, 229, or 81 percent, had at least one circumstantial factor, and the average number of circumstantial factors per fatal accident was 2.4. During the study period, jets were involved in 108 fatal accidents, or 38 percent of the total; turboprops in 140, or 49 percent of the total; and business jets in 35, or 12 percent of the total.

Ten circumstantial factors accounted for 78 percent of all fatal accidents and 97 percent of those that had at least one circumstantial factor assigned (Table 1). "Non-fitment of presently available aircraft safety equipment" — hereafter abbreviated as "aircraft safety equipment" — was involved in 94 fatal accidents, 33 percent of the total.

In 80 of those 94, or 85 percent, the safety equipment lacking was one of the latest terrain awareness and warning systems (TAWS), such as the enhanced ground-proximity warning system (EGPWS). The count included instances when the aircraft was not required to have the equipment installed or the equipment was not available at the time. "The intention was to identify fatal accidents where use of more-advanced technology or extending the coverage

Top 10 Circumstantial Factors, Worldwide Civil Aviation Fatal Accidents, 1997–2006

Rank	Circumstantial Factor	Number of Fatal Accidents	Percentage of Total
1	Non-fitment of presently available aircraft safety equipment	94	33
2	Poor visibility or lack of external visual reference	89	31
3	Failure in crew resource management	81	29
4	Other weather	79	28
5	Company management failure	76	27
6	Inadequate regulatory oversight	69	24
7	Incorrect/inadequate procedures	31	11
8	Inadequate training	30	11
9	Inadequate regulation	26	9
10	Non-fitment of presently available air traffic control system or equipment	25	9

Note: These circumstantial factors are not mutually exclusive.

Source: U.K. Civil Aviation Authority

Table 1

Top 10 Circumstantial Factors, Worldwide Civil Aviation Fatal Accidents, by On-Board Fatalities, 1997–2006

Rank	Circumstantial Factor	On-Board Fatalities	Percentage of Total
1	Poor visibility or lack of external visual reference	2,833	33
2	Non-fitment of presently available aircraft safety equipment	2,787	32
3	Inadequate regulatory oversight	2,552	30
4	Other weather	2,374	28
5	Company management failure	2,208	26
6	Failure in crew resource management	2,137	25
7	Inadequate training	1,588	18
8	Inadequate regulation	1,497	17
9	Non-fitment of presently available air traffic control system or equipment	1,281	15
10	Nonprecision approach flown	1,070	12

Note: These circumstantial factors are not mutually exclusive.

Source: U.K. Civil Aviation Authority

Table 2

Top Circumstantial Factors, Worldwide Civil Aviation Fatal Accidents, by Aircraft Class, 1997–2006

Circumstantial Factor	All Accidents	Jets	Turboprops	Business Jets
Non-fitment of presently available aircraft safety equipment	1 | 4 | 33%*	1 | 39 | 36%	4 | 38 | 27%	1 | 17 | 49%
Poor visibility or lack of external visual reference	2 | 89 | 31%	2 | 32 | 30%	2 | 40 | 29%	1 | 17 | 49%
Failure in crew resource management	3 | 81 | 29%	3 | 30 | 28%	—	3 | 14 | 40%
Other weather	4 | 79 | 28%	4 | 29 | 27%	4 | 38 | 27%	4 | 12 | 34%
Company management failure	5 | 76 | 27%	5 | 27 | 25%	1 | 43 | 31%	5 | 6 | 17%
Inadequate regulatory oversight	6 | 69 | 24%	5 | 27 | 25%	3 | 39 | 28%	—

*1 | 94 | 33% = rank | number | percentage within category

Note: These circumstantial factors are not mutually exclusive.

Source: U.K. Civil Aviation Authority

Table 3

of requirements for an existing technology might have helped to prevent the catastrophic outcome," the report says.

Another technological circumstantial factor, although lowest in the top 10, was "non-fitment of presently available ATC [air traffic control] system or equipment." The example given of such a technology is the minimum safe altitude warning system for ATC radar displays. Lack of state-of-the-art ATC equipment was found in 25 fatal accidents, 9 percent of the total.

The third most frequent circumstantial factor, "failure in CRM," was the only factor appearing in both the causal factor and circumstantial factor lists in the study. "If an accident investigation report clearly cited failure in CRM as a causal factor, then the AAG [the CAA Accident Analysis Group] would also judge it to be a causal factor," the report says. "However, if this was not the case, but the AAG felt that had CRM been to a higher standard during the situation such that the accident might have been prevented, then CRM would be cited as a circumstantial factor."

"Failure in CRM" — with cross-check/coordinate cited as an example — was involved in 81 fatal accidents, or 29 percent of the total.

Of the top 10 circumstantial factors in terms of on-board fatalities, "poor visibility or lack of external visual reference" and "aircraft safety equipment" were practically tied, at 33 percent and 32 percent of fatalities, respectively (Table 2). Again, "non-fitment of presently available ATC system or equipment" came well down on the list, associated with 15 percent of on-board fatalities.

In the overall score among all classes of aircraft in the study, "aircraft safety equipment" ranked at the top, from analysis of reports of 94 fatal accidents (Table 3). It was the most common circumstantial factor for fatal accidents involving jets and business jets, and ranked fourth for those involving turboprops. "Aircraft safety equipment" was a circumstantial factor in 17 business jet fatal accidents, 49 percent of all the business jet fatal accidents in the database.

Analyzed according to the type of flight (Table 4), "aircraft safety equipment" ranked first among circumstantial factors in passenger flights, involved in 63 fatal accidents, or 37 percent of all fatal passenger flight accidents. That circumstantial factor was ranked second among ferry or positioning flights and fourth among cargo flights.

In terms of operator regions, "aircraft safety equipment" ranked highest in the Asia and Middle East region and the Caribbean, Central and South America region (Table 5). It was a contributing factor in 48 percent of the fatal accidents the Caribbean, Central and South America region and a contributing factor in 31 percent of fatal accidents in Europe.

As in the other tables, "poor visibility or lack of external reference" ranked second overall and was tied with "company management failure" in Africa for highest.

Notes

1. U.K. Civil Aviation Authority. "Global Fatal Accident Review 1997–2006." CAP 776. July 21, 2008. Available via the Internet at <www.caa.co.uk/docs/33/CAP776.pdf>.
2. Included in the database were jet and turboprop airplanes (including airplanes built in the Soviet Union or Russian Federation); maximum takeoff weight above 5,700 kg/12,500 lb; civil passenger, cargo, and ferry or positioning flights; and at least one fatality to an occupant. Accidents known to have resulted from terrorism or sabotage were excluded.

Top Circumstantial Factors, Worldwide Civil Aviation Fatal Accidents, by Type of Flight, 1997–2006

Circumstantial Factor	All Accidents	Passenger	Cargo	Ferry/ Positioning
Non-fitment of presently available aircraft safety equipment	1 | 94 | 33%*	1 | 63 | 37%	4 | 20 | 25%	2 | 11 | 33%
Poor visibility or lack of external visual reference	2 | 89 | 31%	2 | 54 | 32%	3 | 22 | 27%	1 | 13 | 39%
Failure in crew resource management	3 | 81 | 29%	4 | 45 | 26%	1 | 25 | 31%	2 | 11 | 33%
Other weather	4 | 79 | 28%	3 | 52 | 31%	—	4 | 10 | 30%
Company management failure	5 | 76 | 27%	4 | 45 | 26%	2 | 24 | 30%	5 | 8 | 24%
Inadequate regulatory oversight	6 | 69 | 24%	—	4 | 20 | 25%	—

* 1 | 94 | 33% = rank | number | percentage within category

Note: The sum, by individual type of flight, of the number of fatal accidents allocated with "company management failure" is 77, one more that the total in the "all types of flight" column. This is because of a midair collision that involved a passenger and cargo flight, for which this circumstantial factor was counted against each type of flight. This midair collision was treated as one fatal accident in the overall statistics.

These circumstantial factors are not mutually exclusive.

Source: U.K. Civil Aviation Authority

Table 4

Top Circumstantial Factors, Worldwide Civil Aviation Fatal Accidents, by Operator Region, 1997–2006

Circumstantial Factor	All Accidents	Africa	Asia and Middle East	Caribbean, Central and South America	Europe	North America	Oceania
Non-fitment of presently available aircraft safety equipment	1 | 94 | 33%*	5 | 14 | 22%	1 | 22 | 37%	1 | 22 | 48%	2 | 22 | 31%	4 | 13 | 32%	5 | 1 | 33%
Poor visibility or lack of external visual reference	2 | 89 | 31%	1 | 17 | 27%	4 | 19 | 32%	3 | 16 | 35%	3 | 21 | 30%	2 | 24 | 34%	2 | 2 | 67%
Failure in crew resource management	3 | 81 | 29%	—	2 | 21 | 35%	2 | 19 | 41%	3 | 21 | 30%	—	—
Other weather	4 | 79 | 28%	4 | 15 | 23%	2 | 21 | 35%	4 | 12 | 26%	5 | 17 | 24%	5 | 12 | 29%	2 | 2 | 67%
Company management failure	5 | 76 | 27%	1 | 17 | 27%	5 | 14 | 23%	5 | 8 | 17%	1 | 23 | 33%	2 | 14 | 34%	5 | 1 | 33%
Inadequate regulatory oversight	6 | 69 | 24%	3 | 16 | 25%	5 | 14 | 23%	—	—	1 | 16 | 39%	2 | 2 | 67%

* 1 | 94 | 33% = rank | number | percentage within category

Note: The sum, by individual operator region, of the number of fatal accidents allocated with "company management failure" is 77, one more that the total in the "all regions" column. This is because of a midair collision that involved a European and a Middle Eastern operator, for which this circumstantial factor was counted against each region. This midair collision was treated as one fatal accident in the overall statistics.

Accident reporting criteria are not consistent throughout the world, so the number of factors assigned to fatal accidents may vary widely among the different operator regions. Care should be taken when drawing conclusions from these data, the U.K. CAA says.

These circumstantial factors are not mutually exclusive.

Source: U.K. Civil Aviation Authority

Table 5