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Business Aviation Safety Brief

Summary of Global Accident Statistics

2004-2008

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1.0 Introduction

Business Aviation has established a record as one of the world's safest forms of transportation. Professionally flown aircraft of all sizes are operated on unscheduled routes to all corners of the globe, yet the safety record continues to be excellent in spite of the very challenging operating environment.

The exemplary safety record of business aviation can be attributed to professionalism and attention to safe operating practices. The business aviation community promotes safety through industry standards and good training, as well as through monitoring and analysing safety information to facilitate continuous improvement. The business aviation representative associations assist operators by providing safety data and programs in their respective countries. The Council representing the national and regional associations at the global level, the International Business Aviation Council (IBAC), has in turn developed a program to collect and analyse worldwide information. To that end, IBAC has contracted with Robert Breiling and Associates to develop global data on business aircraft accidents.

Summary information presented in this Brief is taken from the analysis conducted by Robert Breiling and Associates in 2009. Breiling's detailed Report contains information on accidents from all regions of the world.

This Business Aviation Safety Brief covers a five year period from 2004 to 2008. IBAC will update the Brief annually and the IBAC Planning and Operations Committee (POC) will review the information continuously to determine useful trend data. In addition, the IBAC Governing Board has determined that the Safety Brief will be scrutinized from time to time by independent organizations and feedback will be considered by IBAC's POC.

This summary data includes all accidents involving aircraft when used in conducting business operations. It does not include accidents of business aircraft when used in airshows and other non-business related flying.

Listings of Business Jet and Turboprop accidents that occurred in the preceding calendar year (i.e. 2008) are contained in Appendices A & B.

The compilation, analysis and publication of safety data is an essential foundation for the development of measures to prevent accidents and thus, is not a means unto itself. In this regard, and as a separate IBAC initiative, the International Standard for Business Aircraft Operations (IS-BAO) was introduced in 2002 and was designed to raise the safety bar by codifying safety best practices.

Recognizing that it will be many, many years before safety data will reflect the impact of the IS-BAO, IBAC commissioned an independent, retrospective analysis to subjectively assess the extent to which (i.e. in terms of probability) had the IS-BAO been implemented by the operator concerned the accident could have been prevented. A synopsis of the findings of this study are presented in Section 5.0.

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2.0 Business Aviation Community

2.1 Number of Turbine Aircraft

The Breiling Report contains data covering a five year period for the global population and the distribution of aircraft by region. A summary of the aircraft population in 2008, the last year covered by the report, is as follows:

2008 Global Business Aircraft Population	
Business Jets	16,485
Turbo Props	12,127
All Turbine Business A/C	28,612

Table 2.1a

Analysis

Business aircraft in North America represent 69% of the global fleet. South and Central America have approximately 10.4% and Europe 10.8% of the world's fleet. Other regions account for the remaining 10% of the fleet.

2.2 Number of Flight Hours

The 2008 summarized flight hour totals are as follows:

2008 Global BusAv Flight Hours	
Business Jets	6,258,613
Turbo Props	4,600,585
All Turbine Business A/C	10,859,198

Table 2.2a

Analysis

For the period 2004-2008, flying hours in North America represents 65% of the total, Europe 12.5%, Central/South America 11.2%, and the rest of the world 11%.

2.3 Number of Departures

The number of business aviation departures in the 2008 year is as follows:

2008 Global BusAv Departures	
Business Jets	4,494,989
Turbo Props	2,945,906
All Turbine Business A/C	7,440,895

Table 2.3a
(*Note: These are derived figures based on flight hours and sector durations typical for each category of jet and turboprop aircraft.*)

2.4 Organization of the Community

Business Aircraft operations are classified into three (3) separate categories:

1. **Business Aviation Commercial**
Aircraft flown for business purposes by an operator having a commercial operating certificate (generally on-demand charters).

2. **Corporate**
Non-commercial operations with professional crews employed to fly the aircraft.

3. **Owner Operated**
Aircraft flown for business purposes by the owner of the business.

(Note : Consult IBAC for formal definitions of the three categories. Two additional classifications are included in the Breiling Report, namely Government (public operations) and Manufacturer aircraft. These are not, by their use, considered to be "business aircraft", but are included in the data for completeness.)

3.0 Business Aircraft Global Accident Data
(5 year period 2004 – 2008)

3.1 Accidents by Operator Type

A summary of the total accidents over five (5) years by type of operator is as follows:

Accidents by Operator Type - Jet Aircraft				
Business Jet Aircraft	Total Accidents (5 yrs)	Fatal Accidents (5 yrs)	Average Total Accidents per year	Average Fatal Accidents per year
Commercial	92	24	18.4	4.8
Corporate	44	5	8.8	1.0
Owner Operated	21	5	4.2	1.0
Government	5	2	1.0	0.4
Fractional	10	0	2.0	0

Table 3.1a
*(Note: No analysis provided for **Manufacturer** operations conducted with **Jet Aircraft**)*

Accidents by Operator Type - Turbo Prop Aircraft				
Turbo Prop Aircraft	Total Accidents	Fatal Accidents	Average Total Accidents per year	Average Fatal Accidents per year
Commercial	212	62	42.4	12.4
Corporate	23	6	4.6	1.2
Owner Operated	107	37	21.4	7.4
Government	12	6	2.4	1.2
Manufacturer	1	1	0.2	0.2

Table 3.1b
*(Note: No analysis provided for **Fractional** operations conducted with **Turbo Prop Aircraft**.)*

Analysis

The majority of business aircraft accidents occur in the commercial category, where operations are governed by commercial regulations (such as FAA Part 135 and JAR OPS 1). The next most frequent number of accidents occurs with aircraft flown by business persons. Accidents of corporate aircraft remain rare.

3.2 Accident Summary by Phase of Flight

Five (5) year totals by phase of flight are as follows:

Accident Summary by Phase of Flight									
	Taxi	T/O	Climb	Cruise	Desc't	Man'v	App	Land	Total
Business Jets	17 10%	22 12.8%	11 6.4%	6 3.5%	7 4.1%	2 1.5%	15 8.8%	91 53.2%	171 100%
Turbo Props	15 3.9%	45 11.7%	41 10.7%	43 11.2%	9 2.3%	20 5.2%	63 16.4%	148 38.5%	384 100%

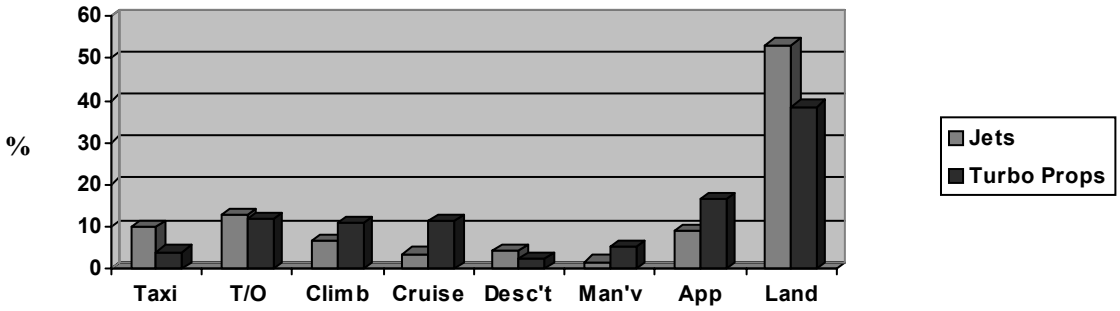


Table 3.2a

Analysis

The trend over a period of 35 years demonstrates a notable decrease in accidents in the landing phase, although landing accidents remain as the most prevalent.

The trend indicates an increase in the number of accidents occurring in the approach phase. The percentage of accidents in the climb phase has also increased substantively for turbo prop aircraft. The distribution of accidents in the other phases has remained relatively unchanged.

(Note: Supplementary data collected by Robert Breiling over a 35 year period was used to develop this trend.)

4.0 Global Accident Rate Data

4.1 Accident Rate by Aircraft Type

The accident rate per 100,000 flight hours for each year over a five year period, as well as for the total, is as follows:

Accident Rate per 100,000 hours by Aircraft Type												
	2004		2005		2006		2007		2008		**5 Year Total**	
	Acc Rate	Fatal Rate	Acc Rate	Fatal Rate	Acc Rate	Fatal Rate	Acc Rate	Fatal Rate	Acc Rate	Fatal Rate	**Acc Rate**	**Fatal Rate**
Business Jets	0.73	0.19	0.56	0.13	0.69	0.13	0.63	0.13	0.69	0.14	**0.64**	**0.14**
Turbo props	1.85	0.54	1.46	0.39	1.39	0.41	1.6	0.56	2.11	0.78	**1.78**	**0.54**
All Bus A/C	1.31	0.45	0.98	0.25	1.01	0.26	1.05	0.32	1.29	0.38	**1.14**	**0.32**

Table 4.1a

Note: Some of the above figures have been re-stated as a result of the availability of subsequently published accident investigation reports and/or additional information.

4.2 Accident Rate by Operator Type

Global data for the numbers of aircraft in each of the business aviation operational categories (commercial, corporate and owner-operated) proved difficult to obtain as few States collect this information. Similarly, flight hours by type of operation are not available. Due to the lack of good exposure data, it was not possible to calculate, without some error, the rate of each category of operation. Additionally, the operational status of a single airframe may legally vary from flight to flight (i.e., an aircraft may be commercial on one flight and private on a flight made later on the same day or vice versa).

Nevertheless, by applying US data relevant to the division between categories of operator, and by making the assumption that the division is relatively similar for the rest of the world, an estimate of the rate by operator type can be made. Given that the North American data represents approximately 67% of the global total, it is unlikely that the distortion generated by the assumption will be very large.

The percentage of flight hours based on FAA published statistical data for each of the three categories in the USA is as follows:

Commercial (Air Taxi)	30.4%
Corporate	55.3%
Owner-operated	14.3%

Ed note:
Additional information is provided at Appendix C. The profiling for the above three categories has changed significantly from that in all Safety Briefs prior to Issue 7. Consequently the data presented in the tables which follow cannot be directly compared with that in the same tables in previous editions of the Safety Brief, and vice versa.

Assuming a similar global division into Commercial (Air Taxi), Corporate and Owner-operated aircraft, the accident rates per 100,000 flight hours are as follows (based on data over 5 years):

Global Accident Rates by Operator Type *(Extrapolated)*
(per 100,000 flight hours)
All Business Aircraft

Operator Type	Hours of Operation (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	15,560,674	304	86	1.95	0.55
Corporate	28,306,094	67	11	0.24	0.04
Owner-operated	7,319,659	128	42	1.75	0.57
*All Business Aircraft	51,186,428	568	160	1.11	0.31

Table 4.2a

*Note: *This line includes the three lines above it, plus **Government**, **Manufacturers** and **Fractional** aircraft operators. Also included are accidents involving operators for which insufficient information was available to assign the operator type.*

Global Accident Rates by Operator Type *(Extrapolated)*
(per 100,000 flight hours)
Jet Aircraft

Operator Type	Hours of Operation (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	8,506,056	92	24	1.08	0.28
Corporate	15,473,188	44	5	0.28	0.03
Owner-operated	4,001,204	21	5	0.52	0.12
*All Business Aircraft	27,980,449	178	40	0.64	0.14

Table 4.2b

*Note: *This line includes the three lines above it, plus **Government**, **Manufacturers** and **Fractional** aircraft operators. Also included are accidents involving operators for which insufficient information was available to assign the operator type.*

Global Accident Rates by Operator Type *(Extrapolated)* *(per 100,000 flight hours)* **Turbo Prop Aircraft**					
Operator Type	Hours of Operation (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	7,054,617	212	62	3.00	0.88
Corporate	12,832,906	23	6	0.18	0.05
Owner-operated	3,318,549	107	37	3.22	1.11
*All Business Aircraft	23,205,979	390	120	1.68	0.52

Table 4.2c

*Note: *This line includes the three lines above it, plus **Government**, **Manufacturers** and **Fractional** aircraft operators. Also included are accidents involving operators for which insufficient information was available to assign the operator type.*

Analysis

The accident rates calculated in Table 4.2a include both turbo-prop and jet aircraft. The rate data indicates an excellent level of safety in corporate operations, whereas the accident rates in the Commercial and Owner-Operated sectors warrants increased attention by the business aviation community.

4.3 Accident Rate by Departures

There is a growing trend for organizations reporting safety data to do so using accident rates per number of departures given that safety exposure is greatest during departure and arrival. Accidents of aircraft en-route are rare except for flights in low level flight in marginal visual conditions. Accident rates per departure, or flight segment or cycle, therefore provide more realistic safety correlations.

Ed note:
Additional information is provided at Appendix C. The profiling for the above three categories has changed significantly from that in all Safety Briefs prior to Issue 7. Consequently the data presented in the tables which follow cannot be directly compared with that in the same tables in previous editions of the Safety Brief, and vice versa.

The accident rate per 100,000 departures is as follows:

Business Jet Accidents and Rates by Departures *(per 100,000 departures)*					
Accident Rate	Departures	Accidents (5 Years)		Accident Rate	
		Total	Fatal	Total	Fatal
Large Jet Aircraft	7,689,072	35	5	0.75	0.11
Medium Jet Aircraft	6,274,989	50	12	0.80	0.19
Light Business Jets	9,005,331	93	23	1.03	0.26
*All Business Jets	19,969,392	178	40	0.89	0.20

Table 4.3a

Business Turbo Prop Accidents and Rates by Departures *(per 100,000 departures)*					
	Departures	Accidents (5 Years)		Accident Rate	
		Total	Fatal	Total	Fatal
Large Turbo Prop	763,252	67	18	8.78	2.36
Medium Turbo Prop	13,246,327	294	93	2.22	0.70
Light Turbo Prop	829,974	29	9	3.49	1.08
All Turbo Prop	14,859,553	390	120	2.62	0.81

Table 4.3b

All Business Turbine Accidents and Rates by Departures *(per 100,000 departures)*					
	Departures	Accidents (5 Years)		Accident Rate	
		Total	Fatal	Total	Fatal
All Business Aircraft	34,828,945	568	160	1.63	0.46

Table 4.3c

If an assumption is made that the distribution of departures for operator types of commercial (30.4%), corporate (55.3%) and owner-operated (14.3%) is relatively the same as the distribution between flight hours, the accident rates by type of operation can be calculated as follows:

Business Aircraft Accident Rates by Operator Type *(Extrapolated)* *(per 100,000 departures)* **All Business Aircraft**					
Operator Type	Departures (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	10,587,999	304	86	2.87	0.81
Corporate	19,260,406	67	11	0.35	0.06
Owner-operated	4,980,539	128	42	2.57	0.84
*All Business Aircraft	34,828,945	528	148	1.52	0.42

Table 4.3d

Business Aircraft Accident Rates by Operator Type *(Extrapolated)* *(per 100,000 departures)* **Jet Aircraft**					
Operator Type	Departures (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	6,070,695	92	24	1.52	0.40
Corporate	11,043,073	44	5	0.40	0.04
Owner-operated	2,855,623	21	5	0.74	0.18
*All Business Aircraft	19,969,392	178	40	0.89	0.20

Table 4.3e

Business Aircraft Accident Rates by Operator Type *(Extrapolated)* *(per 100,000 departures)* **Turbo Prop Aircraft**					
Operator Type	Departures (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	4,517,304	212	62	4.69	1.37
Corporate	8,071,328	23	6	0.28	0.07
Owner-operated	2,124,916	107	37	5.04	1.74
*All Business Aircraft	14,859,553	390	120	2.62	0.80

Table 4.3f

Analysis

A number of assumptions have been made related to the distribution of exposure data, and as a result the data should be used with some caution. Nevertheless, no other rate data is known to exist for worldwide business aviation. The results of the extrapolation should be sufficiently accurate to provide a reasonable comparison with accident information from other aviation sectors.

4.4 Comparison With Other Aviation Sectors

IBAC is experiencing increasing difficulty in drawing meaningful comparisons of business aviation safety data i.e. accident rates per 100,000 departures with those developed and published for other sectors of the aviation community. The incongruencies inhibiting such comparisons include; operational classification i.e. commercial vs. non-commercial, classification of accidents involving fatalities i.e. passengers only or crew, hull loss accidents, range of aircraft MCTOM encompassed by the data, lack of disaggregation by power plant i.e. turbojet, turboprop or recips etc. While it is unlikely that these incongruencies can ever be fully reconciled, IBAC is making every effort to understand and identify these factors and will continue to promote international recognition of the IBAC safety data.

Aviation Sector	Fatal Accident Rate (per 100,000 departures)
All Business Aircraft (Jet and Turbo Prop)*	0.46
Corporate Aviation (Jet and Turbo Prop)**	0.06
All Business Jets***	0.20
Boeing Annual Report – Jet aircraft MCTOM over 60,000lbs engaged in commercial scheduled passenger operations.****	0.048

Table 4.4a

*Per Table 4.3c. IBAC rate is 5 year average.
**Per Table 4.3d. IBAC rate is 5 year average.
***Per Table 4.3a. IBAC rate is 5 year average.
****Boeing – Statistical Summary of Commercial Jet Airplane Accidents, Worldwide Operations 1959-2007. Rate is for a 10 year period, 1999-2008

4.5 Accident Rate Trend

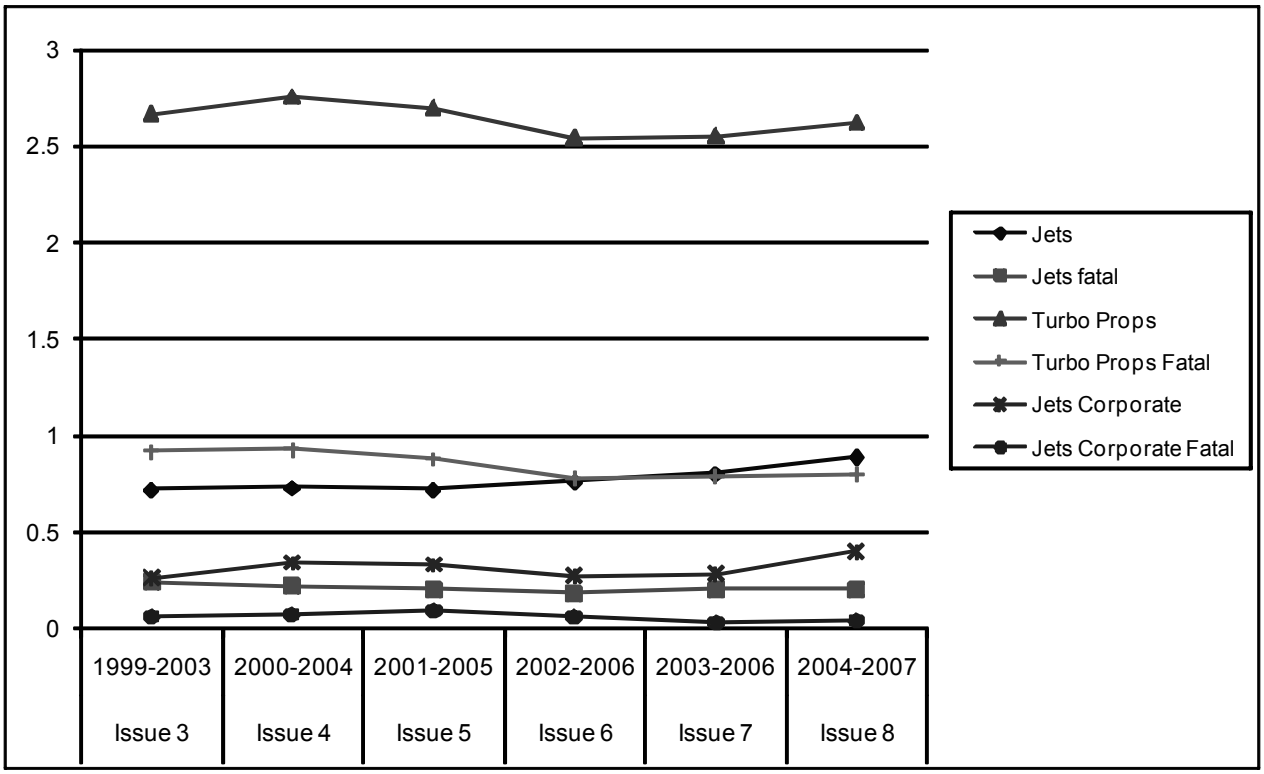


Table 4.5a
Accident rate per 100,000 departures

5.0 IS-BAO Safety Value

A Code of Practice

The International Standard for Business Aircraft Operations (IS-BAO) is an industry safety standard introduced in 2002 as the industry's code of practice designed to raise the safety bar by codifying safety best practices. Given that there are very few accidents in the business aviation community, it will be many years before a determination can be made regarding whether or not the IS-BAO is making a safety impact. Therefore, to assess the safety value a study was initiated based on historical accident data.

An analysis of past accidents required a considerable amount of subjective assessment as the analysts had to review the details of accidents against a full understanding of the IS-BAO to make a value judgment regarding whether the accident may have been avoided if the IS-BAO had been implemented.

The study was conducted by an independent analyst who reviewed a total of 500 accidents covering the period between 1998 and 2003. A total of 297 accidents of the 500 were considered to contain sufficient information to be further assessed. The study against the provisions of the IS-BAO standard was performed to determine a level of probability that if the flight department had known about and implemented the IS-BAO the accident may have been avoided. The data was classified and analyzed to determine the potential impact of the IS-BAO and the accidents were rated on a five point scale ranging from certainty of prevention to no effect.

Two assessments were made. First, the analysts made the assumption based on indicators that the flight department may have implemented the IS-BAO, and if implemented, the potential for accident avoidance. The accidents were then further analyzed to determine the potential outcome given that the IS-BAO was implemented in full before the accident. An audit by an accredited auditor leading to an IBAC Certificate of Registration is the recommended means of demonstrating full implementation.

As part of the analysts' work, the accidents were classified in a number of different ways to see if there were any meaningful trends in the prevention probability between the different factors. Classification methodologies applied include:

1. Simple Four Factors – Human, Technical, Environmental and Management.
2. Events – or significant type of accident (such as loss of control).
3. Breakdown on Human Factors.
4. Boeing Accident Prevention Strategies.

Probabilities were calculated for all accidents, phase of fight, type of accident, four factors (per above), type of operation, Commercial or non-commercial, fatalities and single versus two pilot operations.

A further step in the methodology included a quality assurance analysis by a group of current pilots through an assessment of a random selection of twelve accidents as a means of verifying the results of the analysts.

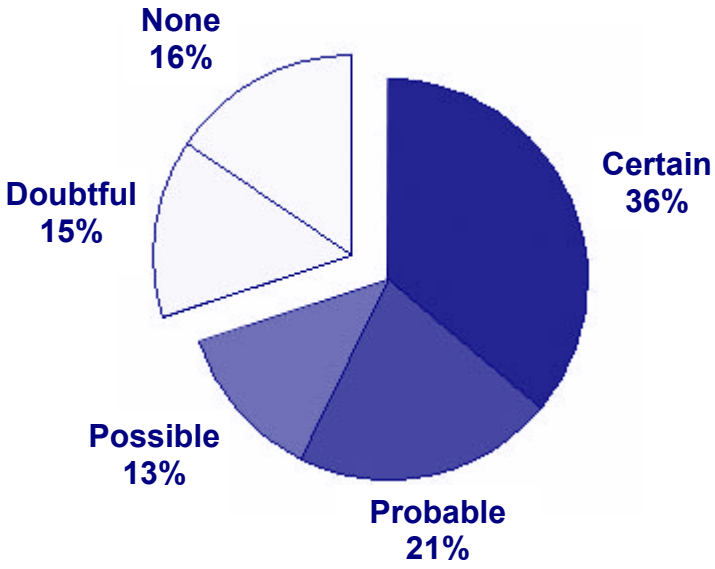
Results of Analysis

Criteria A

Assumes Operators Had Completely Implemented IS-BAO Prior to the Occurrence.

This part of the analysis made the assumption that the operator had implemented the IS-BAO standard in full. An assessment was then made regarding the potential that the accident could have been prevented. The following were the results of the assessment.

Certain of prevention	36.0% (107 of 297 accidents)
Probable prevention	21.2% (63 of 297)
Possible prevention	12.8% (38 of 297)
Doubtful of prevention	14.5% (43 of 297)
No prevention possibility	15.5% (46 of 297)



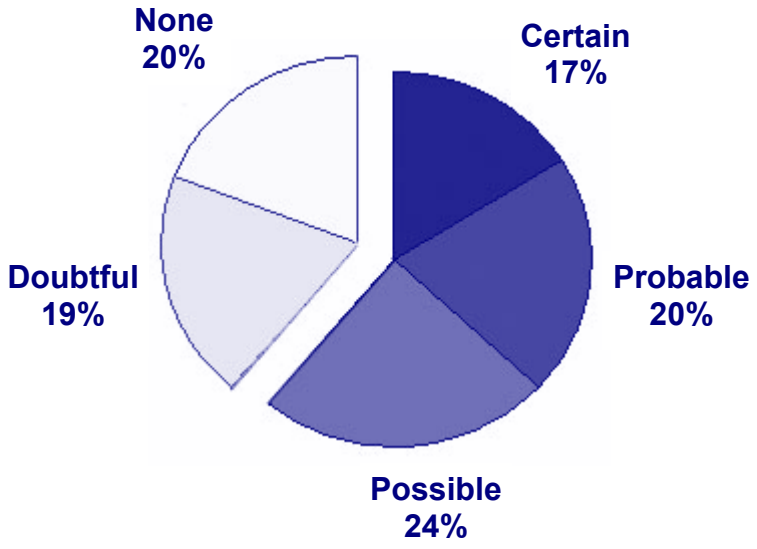
Conclusion - The probability of prevention is 57.2%, with a further 12.8% possible for a total of 70% potential that the aircraft accident could have been avoided.

Criteria B

Takes into Account Operators Background and Probability of Introduction of IS-BAO.

The assessment of whether the accident may have been prevented if the flight department had known about the IS-BAO, and if the operator was sufficiently responsible to implement the standard and had done so thoroughly, produced the following results:

Certain of prevention	17.2% (51 of 297 accidents)
Probable prevention	20.2% (60 of 297)
Possible prevention	23.9% (71 of 297)
Doubtful of prevention	19.2% (57 of 297)
No prevention possibility	19.5% (58 of 297)



Conclusion - The probability of prevention is 37.4%, with a further 23.9% possible for a total of 61.3% potential that the aircraft accident could have been avoided.

Criteria C
Probability of Prevention by Types of Operation and Aircraft.

The analysis showed that there is a greater probability that the accident could have been prevented for jet aircraft type accidents versus turboprop. This was a trend consistent through most methods of analysis and type of accident, although in some cases there was little to distinguish between jet and turboprop probabilities. For example, for the landing accidents (the most common type of accident) the probability of prevention was much greater for jets than turboprop aircraft. Yet, for loss of control accidents there was substantially no difference. The reason for the difference considered by the analysts was that there would be a greater potential for prevention in two pilot operations more typical in jet aircraft.

As would be expected there was a significantly greater probability of prevention related to Management Factors compared to Environmental factors, whereas Technical Factors and Human Factors ranked in the middle of these two.

There was no significant difference between the probability of prevention of commercial operations (air taxi) versus non-commercial. Evidence indicates that there is a higher probability that IS-BAO implementation would prevent accidents with two pilot operations versus one pilot.

Accidents with causal factors related to human performance totaled 232, and were broken down into the following;

1. Knowledge Based (no standard solution) 37
2. Rule Based (need to modify behaviour) 46
3. Skill Based (routine practiced tasks) 149

There was no significant difference between the probability of prevention between these three categories.

Conclusion

The study by an independent analyst indicates that the IS-BAO standard has considerable potential to improve safety. The extent of potential benefit depends significantly on the commitment of the operator to implement and adhere to the standard.

Appendix A

Business Jet Accidents 2008 (U.S. Registered)

2008 Business Jet Accidents (U.S. Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
2/1/2008	NA-265.80	Hit other aircraft during taxi due to a hydraulic malkmctionlfailure	NA	Taxi	Corp	No
2/1/2008	CE-525	Tookoft in freezing weather and crashed shortly thereafter	NA	Climb	Pvt./Bus	Yes
2/12/2008	Premier I	Overshot runway on landing into a ditch in freezing rain, IMC	NA	Landing	Pvt./Bus	No
2/21/2008	L-35A	Left wing struck the runway during landing	NA	Landing	Comm	No
3/4/2008	CE-500	Acft, encountered multiple bird strikes on climb. crashed off apt	NA	Climb	Corp	Yes
4/3/2008	CE-750	Brake malfunction landing, aircraft veered off runway side	NA	Landing	Corp	No
4/8/2008	CL-600-28	Multiple bird strives on initial climb after takeoff	NA	Climb	Corp	No
4/15/2008	CE-56OXL	Landing gear collapsed during landing roll. VMC, day	NA	Landing	Frax	No
4/17/2008	Eclipse 500	Rudder trim stuck during practice engine out approach training	NA	Approach	Pvt./Bus	No
4/30/2008	CE-560	Aircraft veered off runway side during landing. x-wind, gusts	NA	Landing	Corp	No
5/21/2008	BJ-400	During a forced landing. the nose gear collapsed damaging nose	NA	Landing	USAF	No
6/6/2008	CE-510	Aircraft struck by tug while parking	NA	Static	Pvt./Bus	No
7/30/2008	Eclipse	Acft. overshot runway into an embankment during landing. VMC	NA	Landing	Pvt./Bus	No
7/31/2008	HS-800	Late abort- runway overshoot. hit antenna. T storms in area	NA	Landing	Comm	Yes
8/3/2008	CE-550	Aircraft collided with tractor on runway while landing	NA	Landing	Corp	No
8/9/2008	MS-760	Nose pitched up TO due seat belt fastened around control stick	Takeoff	Takeoff	Pvt./Bus	No
8/18/2008	CE-501	Aircraft impacted coastal waters after departure in Puerto Rico	NA	Climb	Pvt./Bus	Yes
9/1/2008	CE-560	Aircraft slid off runway end into a gully following hard a landing	NA	Landing	Frax	No
9/10/2008	L-25	Both wtngtip tanks hit runway during landing	NA	Landing	Comm	No
9/19/2008	L-60	Runway overshoot following late aborted takeoff. due tire(s) blown	NA	Takeoff	Comm	Yes
9/30/2008	L-55	Aircraft caught fire while parked and starting	NA	Static	Comm	No
11/12/2008	CE-680	Aircraft struck by maintenance truck while taxing to park	NA	Taxi	Frax	No
12/14/2008	CL-600-2B	Aircraft landed hard on nose wheel during strong crosswind, VMC	NA	Landing	Corp	No
12/23/2008	Premier I	On landing, aircraft slid off runway end, Lewiston MO	NA	Landing	Corp	No

Appendix A

Business Jet Accidents 2008 (Non-U.S. Registered)

2008 Business Jet Accidents (Non-U.S. Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/24/2008	CE-500	During a post maintenance flight the nose gear jammed	Europe	Landing	Comm	No
1/27/2008	HS-125-850	Directional control lost during landing, gear struck lights	Europe	Landing	Comm	No
1/29/2008	BD-700	Tire failed on landing roll damaging hyd, lines. wiring, structure	Europe	Landing	Corp	No
2/18/2008	CE-650	Aircraft crashed into a house reportedly from FL 320	SA	Cruise	Comm	Yes
3/19/2008	Premier I	Runway overshoot landing. aircraft struck boundary wall	Asia	Landing	Comm	No
3/20/2008	CL-600	Nose gear failed to extend, aircraft landed with it retracted	NA	Landing	Public	No
3/28/2008	HS-125-800	Aircraft substantially damaged during landing in Mexico	CA	Landing	Corp	No
3/30/2008	CE-500	Engine vibration reported after takeoff before aircraft crashed	Europe	Climb	Comm	Yes
4/4/2008	CE-560	Right main landing gear fell into open pit during taxi	Africa	Taxi	Corp	No
6/12/2008	L-35A	During takeoff, aircraft veered left off runway side	Europe	Takeoff	Comm	No
7/2/2008	CE-500	Act undershot & struck trees during inst. app. & went around	SA	Approach	Corp	No
7/15/2008	BE-400	Aircraft undershot runway and landed hard	SA	Landing	Comm	No
8/2/2008	L-35A	Gear collapsed during landing, ground fire followed, elec. malf.	CA	Landing	Comm	No
9/4/2008	Corvette	Left main gear failed to extend, collapsed on landing	Europe	Landing	Corp	No
10/5/2008	CE-550	Right main landing gear collapsed during landing	Europe	Landing	Comm	No
10/19/2008	DA-20	Aircraft undershot approach. hit ILS localizer prior landing	Asia	Landing	Comm	No
10/25/2008	G-550	Acft. fuselage struck by loose baggage cart whie parking	Europe	Taxi	Comm	No
11/5/2008	L-45	Acft. pitched over on app .and crashed	CA.	Approach	Comm	Yes
11/28/2008	DA-900	Control lost landing, acft. went off runway side, nose gear coll.	Europe	Landing	Comm	No
11/30/2008	HS-125-700	Aircraft encountered severe had causing extensive damage	Asia	Maneuver	Military	No
12/7/2008	L-23	Acft. crashed into lake executing a circling app. VMC. dusk	CA	Approach	Public	Yes
12/11/2008	CE-510	Aircraft taxied off taxiway into mud and main gear collapsed	Europe	Taxi	Comm	No
12/20/2008	CE-550 II	Brake locked on ldg. roll. aircraft went off runway side, gear coll.	SA	Landing	Military	No

Appendix B

Turboprop Accidents 2008 (U.S. Registered)

2008 Business Turboprop Accidents (U.S. Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/3/2008	PC-12	Lineman struck and fatally injured by rotating prop. while parked	NA	Static	Corp	Yes
1/14/2008	BE-1900C	Crashed into ocean while on visual approach, dark night	NA	Approach	Comm	Yes
1/15/2008	CE-208	On landing nosegear collapsed	NA	landing	Comm	No
1/18/2008	PA-46-500TP	Aircraft lost control during ILS approach in IMC	NA	Approach	Pvt/Bus	Yes
1/31/2008	BE-90C	Aircraft substantially damaged, turbulence encounter	NA	Cruise	Pvt/Bus	No
2/1/2008	BE-C90A	Aircraft crashed on second GPS/RNAV approach in IMC	NA	Approach	Pvt/Bus	Yes
2/5/2008	SA-226AT	Aircraft hit snow pile on takeoff roll and veered off runway side	NA	Takeoff	Comm	No
2/22/2008	BE-1900D	On second GPS approach aircraft landed long and overshot rwy	NA	Landing	Corp	No
3/20/2008	BE-F90	Nose gear collapsed during runway overshoot	NA	Landing	Pvt/Bus	No
4/4/2008	BE-300	Aircraft experienced severe turbulence in flight	NA	Maneuver	Comm	No
4/12/2008	EMB-110PI	Landing gear faced to extend or was forgotten on landing	NA	Landing	Comm	No
4/25/2008	BE-90C	Right main landing gear collapsed during landing in VMC	NA	Landing	Comm	No
5/2/2008	AC-690C	Both main landing gear collapsed taxing after landing	NA	Taxi	Pvt/Bus	No
5/6/2008	BE-90L	Aircraft landed hard due high sink rate and the gear collapsed	NA	Landing	Pvt/Bus	No
5/9/2008	CE-2088	Power loss in cruise, damaged during forced landing	NA	Approach	Comm	No
5/16/2008	BE-200	Inadvertent gear retraction during landing	NA	Landing	Comm	No
5/22/2008	PC-12	Aircraft damaged landing in crosswind and gusts	NA	Landing	Pvt/Bus	No
5/23/2008	BE-1900C	Aircraft impacted terrain after turning the wrong way on IFR	NA	Climb	Comm	Yes
5/30/2008	AC-690A	Landing gear collapsed during landing	NA	Landing	Pvt/Bus	No
6/1/2008	CE-208B	Power lost during climb. aircraft nosed over during emerg. ldg.	NA	Climb	Pvt/Bus	No
6/3/2008	TBM-850	Aircraft impacted terrain during initial climb on an EMS flight	NA	Climb	Pvt/Bus	Yes
6/18/2008	DHC-6	Aircraft crashed during departure in VMC, dayitght	NA	Climb	Comm	Yes
6/22/2008	BE-99	Parachutist struck stabilizer during Jump	NA	Cruise	Pvt/Bus	Yes

Appendix B

Turboprop Accidents 2008 (U.S. Registered continued)

2008 Business Turboprop Accidents (U.S. Registered Con't)

Date	Model	Description	Region	Phase	Operator	Fatalities
6/24/2008	AC-6908	Landing gear collapsed during landing	NA	Landing	Pvt/Bus	No
6/27/2008	DO-328TP	Aircraft destroyed in hangar fire started from stripping chem.	NA	Static	Comm	No
7/6/2008	PC-12	Aircraft rolled and pitched down on final due wake turbulence	NA	Approach	Military	No
7/15/2008	TBM-700	Aircraft rolled inverted, hd trees on short final, crashed, burned	NA	Approach	Pvt/Bus	Yes
7/16/2008	CE-441	Pilot lost control landing, bounced, hit trees and fire followed	NA	Landing	Pvt/Bus	Yes
7/21/2008	BE-200A	Landing gear collapsed during landing roll on training flight	NA	Landing	Public	No
7/28/2008	BE-200	Nose gear collapsed during landing, VMC. day	NA	Landing	Comm	No
8/3/2008	BE-A90	Power loss both engines. crashed during forced landing	NA	Maneuver	Comm	No
8/20/2008	CE-441	Aircraft veered off runway side during takeoff	NA	Takeoff	Pvt/Bus	No
8/20/2008	PA-46TP	Aircraft landed with landing gear retracted	NA	Landing	Pvt/Bus	No
8/22/2008	BE-100	Acft. crashed shortly after takeoff attempting an emergency ldg.	NA	Climb	Corp	Yes
8/31/2008	SA-226TB	Aircraft door separated and struck fuselage in flight	NA	Cruise	Comm	No
9/25/2008	BE-200	Aircraft overshot runway into a creek during landing	NA	Landing	Comm	No
9/29/2008	PC-12	Aircraft impacted hilly terrain during approach. night. clear sky	NA	Approach	Pvt/Bus	Yes
10/12/2008	BE-100	Aircraft crashed after takeoff, nightVMC from Brazil	NA	Climb	Pvt/Bus	Yes
11/1/2008	BE-A90-1	Aircraft reported missing while conducting a survey in Guyana	NA	Maneuver	Comm	Yes
11/3/2008	BE-200	Aircraft crashed shortly after takeoff. no other information	NA	Climb	Pvt/Bus	Yes
11/22/2008	PA46TP	Aircraft impacted terrain during night VMC approach	NA	Approach	Pvt/Bus	Yes
12/3/2008	AC-6908	Aircraft impacted mountainous terrain during descent	NA	Descent	Pvt/Bus	Yes
12/7/2008	CE-208	Aircraft damaged by jumping parachutist who survived	NA	Cruise	Pvt/Bus	No
12/9/2008	MU-28-60	Aircraft veered off runway side during engine out landing	NA	Landing	Pvt/Bus	No
12/14/2008	BE-901	Aircraft crashed during unknown circumstances	NA	Descent	Pvt/Bus	Yes
12/23/2008	TBM-700	Landing gear collapsed during landing	NA	Landing	Pvt/Bus	No
12/27/2008	CE-208	Aircraft went off taxiway and tipped over while taxiing	NA	Taxi	Comm	No

Appendix B

Turboprop Accidents 2008 (Non-U.S. Registered)

2008 Business Turboprop Accidents (Non-U.S. Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/15/2008	BE-C90B	Aircraft crashed during touch and go landing practice	Africa	Climb	Public	Yes
1/16/2008	G-159	Aircraft lost directional control landing and ran off runway side	Africa	Landing	Comm	No
1/19/2008	BE-200	Aircraft crashed during instrument approach in IMC	Africa	Approach	Comm	Yes
2/13/2008	Bae-31	Aircraft undershot approach in wind shear	S.A.	Approach	Comm	No
2/25/2008	EMB-110	Main gear faded to extend and collapsed during landing	C.A.	Landing	Comm	No
3/6/2008	BE-200	Pilot failed to extend the landing gear prior landing	Africa	Landing	Comm	No
3/15/2008	BE-1900C	Aircraft crashed into a village, 3 crew fatal, no other information	Africa	Approach	Comm	Yes
3/19/2008	BE-90B	Gear retracted during landing rod	Europe	Landing	Comm	No
3/27/2008	BE-100A	Nose gear collapsed during landing roll	N.A.	Landing	Comm	No
3/27/2008	TBM-700	Nose gear coll. landing after emery. system improperly used	Europe	Landing	Pvt/Bus	No
3/28/2008	PA-46TP500	Autopilot malfunctioned in cruise, control lost and acft. crashed	N.A.	Cruise	Pvt/Bus	Yes
4/3/2008	CE-406	During a loaning flight the aircraft crashed shortly after takeoff	Africa	Climb	Comm	Yes
4/8/2008	CE-208	Float equipped act. Ided in water with gear down, Aimed over	Oceania	Landing	Pvt/Bus	No
4/9/2008	SA-227AC	Pilot turned wrong way after IFR takeoft,and hit terrain	Oceania	Climb	Comm	Yes
4/21/2008	EMB-110	Aircraft overshot runway during engine out approach	S.A.	Landing	Comm	No
4/23/2008	PA-46-500TP	Aircraft collided with power lines dunng low training flight	Europe	Maneuver	Pvt./Bus	No
4/26/2008	CE-208B	Owing takeoff wing hit tree and aircraft crashed	Africa	Takeoff	Comm	No
4/30/2008	BE-200	Nose gear failed to retract and oodapsed on landing	Africa	Landing	Corp	No
5/2/2008	BE-1900C	Aircraft lost power in both engines short of ft's destination	Africa	Approach	Comm	Yes
5/17/2008	AC-980	Bird strike on approach caused substantial damage	S.A.	Approach	Comm	No
5/23/2008	TAM-700	Landing gear failed to extend . aircraft landed gear up	Europe	Landing	Military	No
6/6/2008	BE-C908	Aircraft veered off runway side during landing roll	C.A.	Landing	Comm	No
6/15/2008	DHC-6300	Aircraft substantially damaged landing at oil camp	Africa	Landing	Corp	No
6/20/2008	SA-226T	Aircraft crashed into the sea during a training flight	Europe	Maneuver	Comm	Yes

Appendix B

Turboprop Accidents 2008 (Non-U.S. Registered continued)

2008 Business Turboprop Accidents (Non-U.S. Registered Con't)

Date	Model	Description	Region	Phase	Operator	Fatalities
7/3/2008	CE-208	Farad landing due to loss of oil pressure	S.A.	Cruise	Comm	No
7/3/2008	PA-31T	Aircraft flew into high terrain	S.A.	Cruise	Pvt/Bus	Yes
7/6/2008	BE-90F	Runway overshoot after landing long and fast	Europe	Landing	Pvt/Bus	No
8/12/2008	SA-226TC	Aircraft substantially damaged flying through heavy rain & hail	S.A	Maneuver	Comm	No
8/24/2008	CE-208	Aircraft crashed following unreported engine problems	C.A.	Cruise	Comm	Yes
9/1/2008	CE-208	Aircraft crashed during landing, no other information reported	C.A.	Landing	Comm	No
9/3/2008	BE-C90B	Takeoff aborted due engine problem, aircraft went off rwy_ side	S.A.	Takeoff	Corp	No
9/7/2008	CE-208B	Power lost during climb. aircraft ditched in sea	C.A	Climb	Comm	No
9/27/2008	BE-200B	Landing gear would not lock and collapsed during landing	Oceania	Landing	Comm	No
10/8/2008	PA-31T	Aircraft taxiied into an open manhole not marked. night	C.A.	Taxi	Corp	No
10/10/2008	EMB-110	Main landing gear collapsed during landing	S.A.	Landing	Comm	No
10/20/2008	BE-C90A	Left main landing gear collapsed during landing roll	C.A.	Landing	Comm	No
10/29/2008	BE-C90	Aircraft crashed executing a missed approach. IMC, day	Asia	Approach	Public	Yes
10/30/2008	BE-200	Left gear collapswed on landing, aircraft went off runway side	N.A.	Landing	Comm	No
11/1/2008	CE-2088	Landed on wrong airstrip. crashed during attempted go-around	Africa	Landing	Comm	No
11/12/2008	BE-100	Aircraft landed with gear retracted, crew failed to extend	NA	Landing	Comm	No
11/22/2008	BE-100A	Aircraft impacted trees & terrain returning to land after takeoff	N.A.	Approach	Comm	No
11/23/2008	BE-200	Aircraft crashed short of runway into residential area. VMC	S.A.	Approach	Comm	Yes
11/8/2008	PC-12	Stick pusher activated on landing causing aircraft to land flat	N.A.	Landing	Comm	No
12/1/2008	BE-100	Directional control lost on landing, aircraft went off runway side	N.A.	Landing	Comm	No
12/16/2008	BE-350	Aircraft flared 10 ft. high and landed hard	Europe	Landing	Comm	No
12/18/2008	PA-31T	Aircraft crashed after takeoff in VMC, daylight, Buenos Aires	S .A.	Takeoff	Comm	Yes
12/18/2008	BE-200	Main landing gear collapsed during landing	Africa	Landing	Corp	No

2008 Large Carrier Jet & Turboprop Accidents

4/29/2008	F-50	Aircraft lost control during emergency engine out landing	Africa	Landing	No
6/22/2008	DHC-8	Aircraft's tail struck runway on landing at a short field	Europe	Landing	No
7/8/2008	DHC-6	Aircraft ran off runway side during landing	Asia	Landing	No
7/16/2008	DHC-6	Aircraft stalled on approach and hit trees	N.A.	Appr.	No
8/11/2008	8E-1900	Nose gear failed to extend and collapsed on landing	N.A.	Landing	No
8/13/2008	F-27	Wing struck tower during approach in marginal wx.	Africa	Appr.	Yes
9/1/2008	BE-1900	Aircraft struck mountain top in marg. wx. & heavy rain	Africa	Appr.	Yes
11/18/2008	DHC-6	Aircraft over ran runway ldg. Slippery rvry, marginal wx	Africa	Landing	No
11/27/2008	BAe-31	Hard landing in marginal wx. And in low visability	N.A.	Landing	No
12/14/2008	DO-228	Aircraft landed short in darkness	N.A.	Appr.	No

Appendix C

Methodology

1. Annual Accident Assessment

IBAC contracts annually to Robert Breiling and Associates to assess and collate business aviation accidents. The Breiling Report provides IBAC with operating hours for each aircraft type as well as accident statistics by aircraft type, by operator type and by area of the world. IBAC uses the information to publish a summary report in the annual *Business Aviation Safety Brief*.

To date the Brief has provided only limited information on accident by operator type due to the lack of acceptable exposure data in terms of hours of operation for each operator type.

It has always been recognized that achieving safety improvement is highly reliant on the knowledge base and understanding of the operations of greater risk so that mitigation can be determined and applied. As an indicator applied to assessing risk, business aviation places importance on statistical comparisons of the accident rate between the different business aviation operational types, namely accident rates for operations of corporate aviation, on-demand commercial and owner operated. Given the difficulty in obtaining exposure data for the hours attributed to each operational type, in the past it has been difficult to obtain with any degree of confidence the accident rates for each operation. However, with recent changes in the methodology and accuracy of an annual survey of general aviation and on-demand Part 135 operators by the US Federal Aviation Administration, IBAC has now concluded that data developed from the Survey is sufficiently accurate to serve as a methodology to provide a global perspective of the difference in rates between the operator types.

Percentage of Operations by Operator Type

The following distribution by operator type is applied to the business aviation hour and departure data to determine exposure by operator used to calculate accident rates: (See Attachment for methodology)

	Jet Average	TP Average	Total
Corporate	60.7%	43.2%	55.3%
Owner Operator	11.3%	21.1%	14.3%
Commercial On-Demand	28.0%	35.7%	30.4%

Table C-1

2. Availability of Exposure Data

The US FAA annually completes a survey of US operators, including hours of flight by operator type. Prior to 2006 IBAC was concerned that the gap between the total flying hours calculated by Robert Breiling was different from those of the FAA. However, over the last couple of years the gap has closed to the point that there is increased confidence in the survey results and IBAC has now concluded that the survey information is sufficiently accurate to provide a reasonable assessment of the differences between accident rates for each operator type.

The FAA survey is sent to 100% of general aviation and on-demand commercial operators of turbine aircraft in the US and follows up three times with operators that do not respond immediately. Submissions are made annually by approximately 45% of the US turbine operator population. The US business aviation fleet consists of 65% of the world fleet and the distribution between operator types is considered representative of the global fleet with the exception of the European fleet. The global distribution and an assessment of each region is as follows;

United States	65%	
North America without the US	8%	Distribution considered similar to the US
South America	7%	Distribution considered similar to the US
Europe	11%	Probable higher percent of on-demand commercial operations.
Rest of the World	9%	Different rule structures but most would be similar to the US

FAA survey data was applied over a three year period to develop an average distribution by aircraft type (Jet, Turbo-Prop and Combined) and operator type (Commercial On-demand, Corporate and Owner-Operated). The data in Table C-1 was applied to the total business aviation hours to calculate the number of flying hours for each operational type.

3. Rate Calculation

Accident rates per operator type were calculated using accident data in the Safety Brief, along with exposure data as explained in S2 above. Tables were developed for both 100,000 flying hours and 100,000 departures.

4. Assumptions

IBAC recognizes that there is error built into the methodology, but given the lack of options the data is considered as accurate as anything available. The following assumptions that give rise to some error are:

The breakdown by operator types is derived from an FAA survey of US operators. An assumption is made that the remainder of the world will have an operator distribution similar to the US. Given that the US consists of approximately 65% of the global fleet, it is unlikely that the error due to this assumption will be very significant.

The FAA survey captured approximately 50% of the total global flying hours. It is assumed that the 50% is representative of the distribution for the complete population.

5. Sensitivity Analysis

As noted above, an assumption is made that the US distribution by operator type is representative of the global fleet distribution and yet it was also concluded that the European fleet distribution is likely different than that of the US. Given the potential that this may result in an unacceptable error, a sensitivity analysis was completed to determine the impact of a higher percentage of the European fleet being operated as on-demand charters.

Two samples for European distribution were selected to test the impact.

Operator Type	Baseline per US Survey	Sample 1	Sample 2
Commercial On-Demand	31%	60%	70%
Corporate	55%	30%	25%
Owner Operated	14%	10%	5%

Results of the analysis demonstrate a very small change when the sample data for Europe is applied. Typically, the sensitivity analysis tables conclude a difference ranging from .01% to .08% in the fatal accident rates, which demonstrates acceptable level of error for the comparison purposes intended by the statistics.

The following Table shows the results of applying to the Safety Brief Issue 6 data the two Sample distributions to the combined jet and turbo-prop fleets.

	Baseline (31/55/14 %)		Sample 1 (Europe 60/30/10 %)		Sample 2 (Europe 70/25/5 %)	
	Total	Fatal	Total	Fatal	Total	Fatal
Commercial On-demand	2.28	0.66	2.48	0.71	2.58	0.74
Corporate	0.18	0.04	0.19	0.04	0.19	0.04
Owner Operated	1.86	0.64	1.85	0.63	1.92	0.64
Combined	1.08	0.31	1.08	0.31	1.08	0.31