Contents

Page Intentionally Left Blank

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 2011. 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 2006 to 2010. 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. 2010) 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.

Page Intentionally Left Blank

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 2010, the last year covered by the report, is as follows:

2010 Global Business Aircraft Population	
Business Jets	18,053
Turbo Props	13,112
All Turbine Business A/C	31,165

Table 2.1a

Analysis

Business aircraft in North America represent 63.7% of the global fleet. South and Central America have approximately 11.8% and Europe 13.9% of the world's fleet. Other regions account for the remaining 10% of the fleet.

2.2 Number of Flight Hours

The 2010 summarized flight hour totals are as follows:

2010 Global BusAv Flight Hours	
Business Jets	6,065,020
Turbo Props	4,875,424
All Turbine Business A/C	10,940,444

Table 2.2a

Analysis

For the period 2006-2010, flying hours in North America represents 62.7% of the total, Europe 13.2%, Central/South America 11.8%, and the rest of the world 12%.

2.3 Number of Departures

The number of business aviation departures in the 2010 year is as follows:

2010 Global BusAv Departures	
Business Jets	4,340,247
Turbo Props	3,314,096
All Turbine Business A/C	7,654,343

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 2006 – 2010)

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	99	26	19.8	5.2
Corporate	39	3	7.8	0.6
Owner Operated	17	3	3.4	0.6
Government	5	1	1	0.2
Fractional	8	0	1.6	0
Manufacturer	1	0	0.2	0

Table 3.1a

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	249	66	49.8	13.2
Corporate	32	9	6.4	1.8
Owner Operated	93	32	18.6	6.4
Government	15	5	3.0	1.0
Manufacturer	2	1	0.4	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 10.1%	16 9.5%	11 6.5%	7 4.1%	6 3.6%	2 1.2%	18 10.6%	93 54.4%	169 100%
Turbo Props	16 4.1%	29 7.5%	41 10.6%	37 9.6%	10 2.6%	21 5.4%	65 16.8%	168 43.4%	387 100%

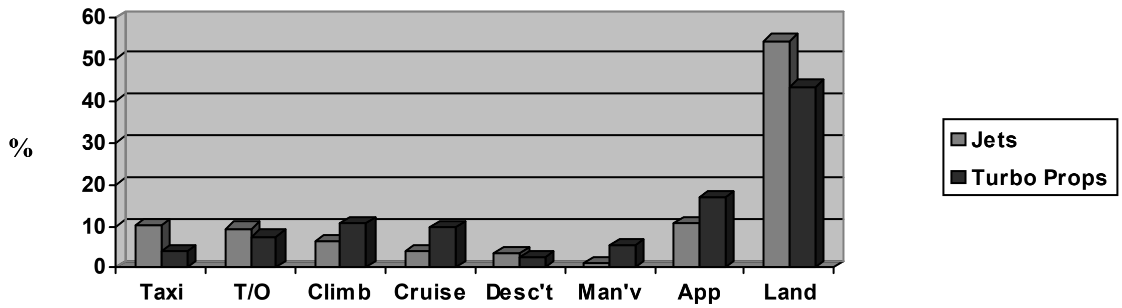


Table 3.2a

Analysis

The trend over a period of 35 years demonstrates a substantive decrease in the percentage of taxi accidents, and 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												
	2006		2007		2008		2009		2010		**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	0.69	0.13	0.63	0.13	0.69	0.14	0.37	0.08	0.48	0.10	**0.64**	**0.14**
Turbo props	1.39	0.41	1.6	0.56	2.11	0.78	0.70	0.46	1.64	0.29	**1.70**	**0.50**
All Bus A/C	1.01	0.26	1.05	0.32	1.29	0.38	0.90	0.24	0.99	0.18	**1.13**	**0.30**

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 64% of the global total, it is unlikely that the distortion generated by the assumption will be very large.

The percentage of flight hours 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 edition of the Safety Brief, and vice versa.

Assuming a similar division globally, 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)	15,199,650	348	92	2.28	0.61
Corporate	27,645,511	71	12	0.26	0.04
Owner-operated	7,148,839	110	35	1.54	0.49
*All Business Aircraft	49,991,884	560	146	1.12	0.29

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)	8,260,027	99	26	1.20	0.31
Corporate	15,025,640	39	3	0.26	0.02
Owner-operated	3,885,473	17	3	0.44	0.08
*All Business Aircraft	27,171,141	169	33	0.62	0.12

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)	6,937,506	249	66	3.59	0.95
Corporate	12,619,870	32	9	0.25	0.07
Owner-operated	3,263,366	93	32	2.85	0.98
*All Business Aircraft	22,820,743	391	113	1.7	0.50

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 4.2 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 sector 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 edition of the Safety Brief, and vice versa.

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

Business Jet Accident and Rate by Departures *(per 100,000 departures)*					
Accident Rate	Departures	Accidents (5 Years)		Accident Rate	
		Total	Fatal	Total	Fatal
Large Jet Aircraft	4,913,605	37	4	0.75	0.08
Medium Jet Aircraft	5,476,187	47	10	0.86	0.18
Light Business Jets	9,054,410	91	23	1.01	0.25
*All Business Jets	19,444,202	175	37	0.90	0.19

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	707,738	64	22	9.04	3.11
Medium Turbo Prop	13,928,229	284	79	2.03	0.57
Light Turbo Prop	876,561	40	12	4.56	1.37
All Turbo Prop	15,512,528	388	113	2.5	0.73

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	34,956,730	563	150	1.61	0.43

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)*					
Operator Type	Departures (5 yrs)	Total Accidents	Fatal Accidents	Total Accident Rate	Fatal Accident Rate
Commercial (Air Taxi)	10,626,845	248	92	2.33	0.87
Corporate	19,331,071	71	12	0.38	0.06
Owner-operated	4,998,812	110	35	2.20	0.70
*All Business Aircraft	34,956,730	563	150	1.61	0.43

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)	5,911,037	99	26	1.67	0.44
Corporate	10,752,643	39	3	0.36	0.03
Owner-Operated	2,780,521	17	3	0.61	0.11
*All Business Aircraft	19,444,202	169	33	0.87	0.17

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)	4,715,809	249	66	5.28	1.40
Corporate	8,578,428	32	9	0.37	0.10
Owner-Operated	2,218,292	93	32	4.19	1.44
*All Business Aircraft	15,512,528	391	113	2.52	0.73

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)*	0.43
Corporate Aviation (Jet and Turbo Prop)**	0.06
All Business Jets***	0.17
Boeing Annual Report – Jet aircraft MCTOM over 60,000lbs engaged in commercial scheduled passenger operations.****	0.042

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 1959-2009. Rate is for Scheduled Commercial Passenger Operations for a 10 year period, 2001-2010

4.5 Accident Rate Trend

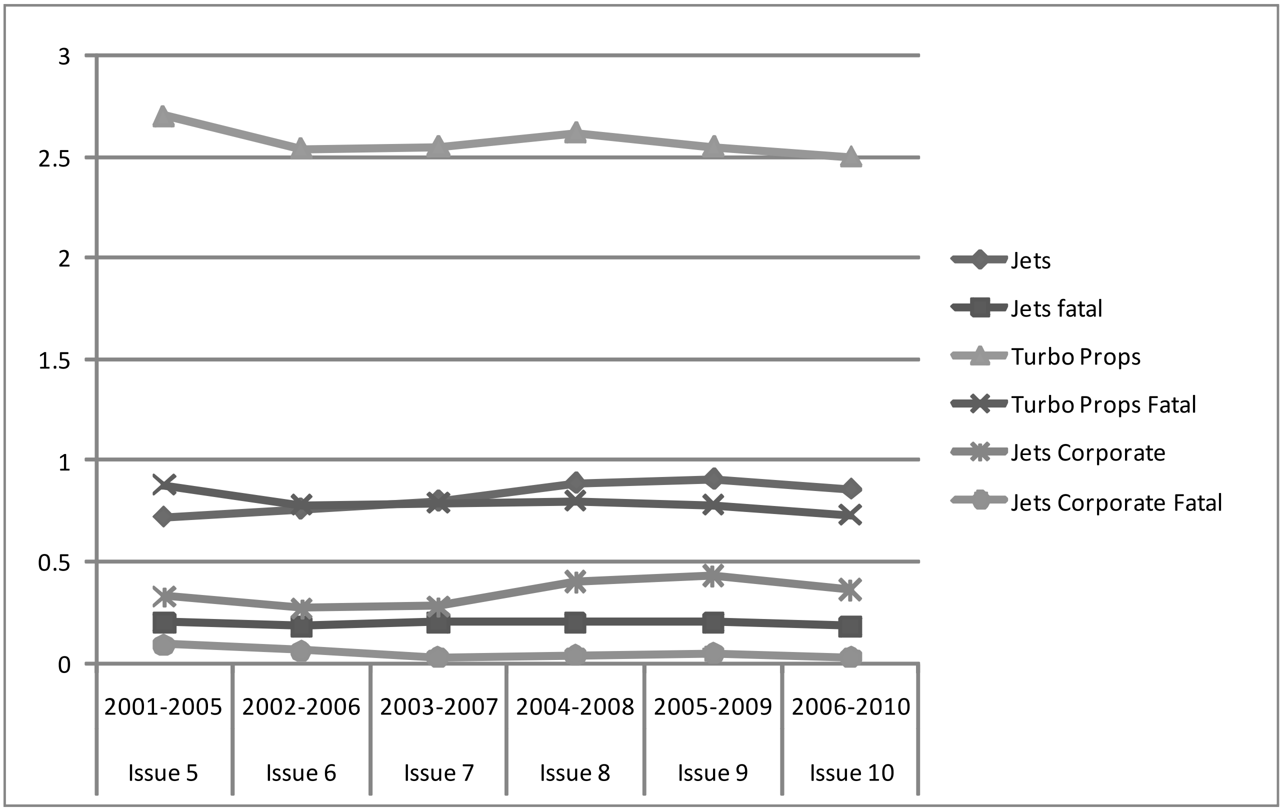


Table 4.5a
Accident rate per 100,000 departures

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.

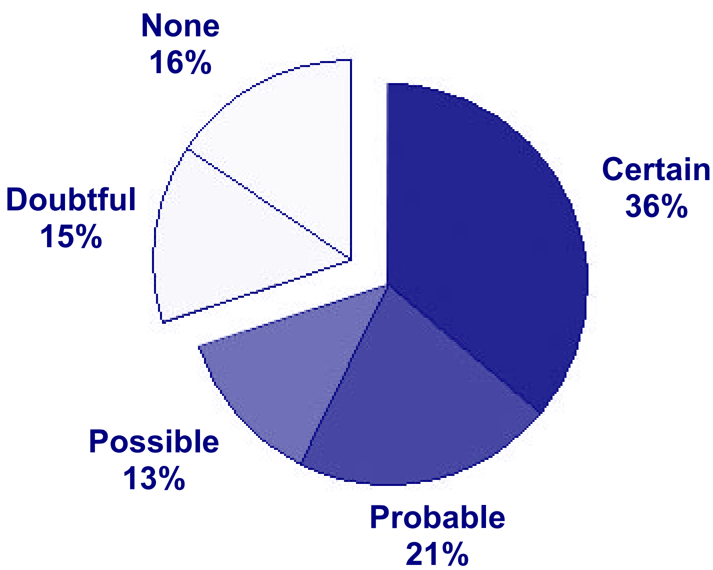
Results of Analysis

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)



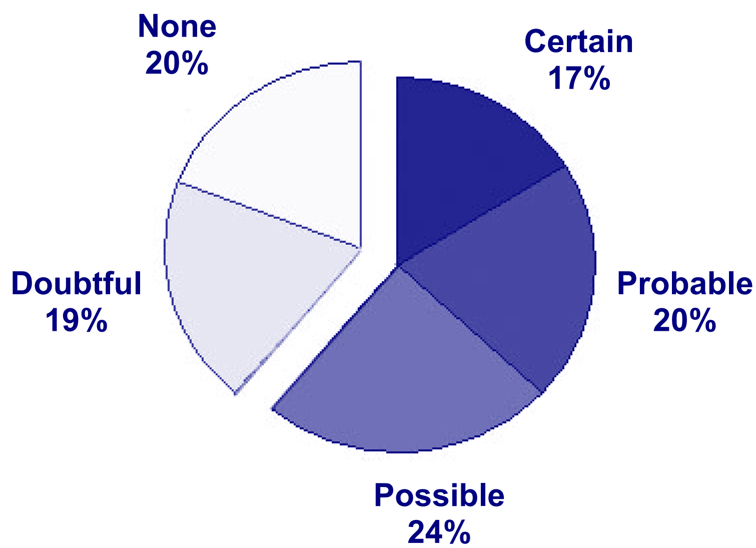
Conclusion - The probability of prevention is 57.2%, with a further 12.8% possible for a total of 70% potential that the aircraft accident could have been avoided.

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 <u>a total of 61.3% potential that the aircraft accident could have been avoided</u>.

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

2010 Business Jet Accidents

(North American Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/5/2010	L-35A	Aircraft crashed 1 mile from airport on approach	N.A.	Approach	Comm	Yes
2/13/2010	CE-680	Aircraft damaged by turbulence near Eagle, CO	N.A.	Cruise	Frax	No
2/24/2010	CL-300	De-icing bucket hit and damaged the stablized prior departure	N.A.	Parked	Frax	No
4/8/2010	G-11	Wing struck window of fuel truck while parking, following guide	N.A.	Taxi	Comm	No
6/7/2010	CE-525	Takeoff aborted due engine fire. runway overshoot	N.A.	Takeoff	Corp	No
6/21/2010	CE-525	Aircraft overshot runway on landing. day VMC	N.A.	Landing	Pvt/Bus	No
7/27/2010	Premier 1	rcraft stelled during steep turn on final to avoid show aircraft	N.A.	Approach	Pvt/Bus	No
7/27/2010	G-IV	Aircraft struck a pole daring maneuvering on the ramp	N.A.	Taxi	Corp	No
9/10/2010	Phenom 100	n landing, aircraft slid off runway end due brake malf / failure	N.A.	Landing	Pvt/Bus	No
10/1/2010	CE-550	Runway overshoot landing, aircraft went into sound	N.A.	Landing	Corp	No
11/17/2010	L-25B	Runway overshoot during landing, nose gear collapsed	N.A.	Landing	Comm	No

(Non-North American Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/8/2010	DA-20	Main tire failed on take-off, aircraft went off runway end into snow	CA	Takeoff	Comm	No
2/14/2010	CE-5505	Aircraft crashed during a night approach in VMC	Europe	Approach	Comm	Yes
3/8/2010	CE-500	Aircraft crashed following engine malfunction and shutdown	Europe	Climb	Comm	Yes
4/1/2010	L-25D	Aircraft landed gear up and fire started under engine no. 2	CA	Landing	Comm	No
4/19/2010	DA-50	Aircraft substanbally damaged by hail while parked	CA	Static	Comm	No
4/20/2010	CL-604	Aircraft veered off runway collapsing nose gear, day, VMC	Europe	Landing	Coro	No
6/18/2010	DA-20F	Engine failure after takeoff. forced landing followed	SA	Climb	Comm	No
7/15/2010	CE-550	Aircraft overshot the runway dunng lending	Europe	Landing	Comm	No
8/12/2010	L-55	Aircraft overshot the runway dunng lending	SA	Landing	Comm	No
8/12/2010	CE-500 I	Aircraft undershot runway and hit locahzer then landed safely	Europe	Approach	Comm	No
8/13/2010	DA-50	Control lost landing, aircraft went off runway side, nose gear coil	Europe	Landing	Comm	No
9/1/2010	CE-550 II	Aircraft overran the ray. Landing in heavy rain, IMC,New Guinea	Oceania	Landing	Comm	Yes
10/6/2010	CE-500SP	Aircraft crashed into sea after takeoff. day, VMC	SA	Descent	Comm	Yes
10/12/2010	CE-560	Aircraft damaged by hail on descent into Melbourne	Oceania	Descent	Comm	No
11/19/2010	CE501SP	Aircraft struck ILS antenna during landing attempt in fog and IMC	Europe	Landing	Comm	No
12/9/2010	CE-750 X	Right main landing gear collapsed during landing	Europe	Landing	Corp	No
12/19/2010	Premier IA	Aircraft crashed during approach to restricted airport St Moritz	Europe	Approach	Comm	Yes

Appendix B

2010 Business Turbo Prop Accidents

(North American Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/2/2010	SA-227	Aircraft slid off runway side into a fence, night, Somerset KY	N.A.	Landing	Comm	No
1/6/2010	BE-99C	Aircraft landed hard following inst. Approach in IMC and icing	N.A.	Landing	Comm	No
1/18/2010	MU-2B-60	Aircraft crashed short of runway on second approach, VMC	N.A.	Approach	Pvt/Bus	Yes
1/19/2010	BE-200	Aircraft landed hard following instrument approach in IMC	N.A.	Landing	Corp	No
1/21/2010	BE-1900C	Aircraft crashed into the ocean following a night takeoff	N.A.	Climb	Comm	No
1/23/2010	BE-90A	Rt. Main gear collapsed ldg, aircraft veered off rwy into ditch	N.A.	Landing	Comm	No
1/26/2010	TBM-700	Aircraft landed with landing gear retracted	N.A.	Landing	Pvt/Bus	No
2/4/2010	MU-2B-60	Aircraft veered off snowy runway side during landing in x-wind	N.A.	Landing	Comm	No
2/4/2010	PA-31T	Aircrafts landing gear collapsed during landing	N.A.	Landing	Pvt/Bus	No
2/12/2010	PA-31T	Aircraft banked sharply on approach and crashed, day, VMC	N.A.	Approach	Pvt/Bus	No
2/17/2010	CE-208B	Wing struck object . Ground during takeoff	N.A.	Climb	Comm	No
2/18/2010	CE-208B	Aircraft Struck bird(s) on final approach to land	N.A.	Approach	Comm	No
3/1/2010	TBM-700	Aircraft crashed while on the approach to Gaithersberg, MD	N.A.	Approach	Pvt/Bus	No
3/1/2010	P-180	Aircraft landed with landing gear retracted at Greensboro, NC	N.A.	Landing	Comm	No
3/2/2010	BE-90A	Left main gear collapsed following a hard landing	N.A.	Landing	Corp	No
3/19/2010	PA-46TP-C	Nose landing gear collapsed during takeoff	N.A.	Takeoff	Pvt/Bus	No
4/3/2010	MU-2B-60	On landing, aircraft veered off runway side & through a fence	N.A.	Landing	Pvt/Bus	No
5/2/2010	PA-46TP cvn	Control lost during day IMC descent, aircraft spiraled into ground	N.A.	Descent	Pvt / Bus	Yes
5/19/2010	SA-228AT	Aircraft landed with landing gear retracted	N.A.	Landing	Comm	No
5/20/2010	PA-42	Aircraft overshot runway end following an in-flight emergency	N.A.	Landing	Comm	No
5/23/2010	TBM-700	Power lost in flight aircraft overshot runway collapsing gear	N.A.	Landing	Pvt / Bus	No
6/3/2010	BE-90C	Nose wheel collapsed dunng landing roll	N.A.	Landing	Public	No
6/12/2010	BE-1900D	Left main landing gear collapsed during ldg. Due mech. Malf.	N.A.	Landing	Comm	No
6/14/2010	PA-42	Aircraft landed with nose wheel retracted	N.A.	Landing	Public	No

Appendix B

2010 Business Turbo Prop Accidents, continued

(North American Registered, continued)

Date	Model	Description	Region	Phase	Operator	Fatalities
6/18/2010	CE-208	Float equipped Caravan hit a rock during a water landing	N.A.	Landing	Comm	No
6/28/2010	BE-200	Aircraft skidded on landing collapsing the nose wheel	N.A.	Landing	Comm	No
8/1/2010	C-123	Aircraft lost control m flight and crashed, Fairchild C-123, VMC	N.A.	Cruise	Comm	Yes
8/11/2010	DHC-3TP	Aircraft crashed attempting to remain VFR in marginal wx.	N.A.	Maneuver	Corp	Yes
9/12/2010	P-180	Nose gear collapsed during takeoff on a mtnce. test flight	N.A.	Takeoff	Comm	No
9/16/2010	BE-1900C	Landing gear collapsed dunng landing. night cargo flight	N.A.	Landing	Comm	No
10/1/2010	CE-425	Tire blew on landing resulting in gear collapse	N.A.	Landing	Pvt / Bus	No
10/18/2010	BE-100	Bird encounter dunng descent. Palestine. TX	N.A.	Approach	Public	No
10/18/2010	BE-1900	Lightning struck wing during approach, Sitka AK	N.A.	Approach	Comm	No
10/29/2010	PA-46 500TP	Power failed initial climb, faced landing in field	N.A.	Climb	Pvt / Bus	No
11/18/2010	DHC-3TP	Fpoat hil object during water takeoff	N.A.	Takeoff	Comm	No
12/4/2010	PA-46TP Cvn.	Power lost in cruise. aircraft successfully ditched m Guff of Max.	N.A.	Cruise	Pvt / Bus	No
12/10/2010	BE-300	Cabin door separated in flight, aircraft landed safely	N.A.	Climb	Pvt / Bus	No

Appendix B

2010 Business Turbo Prop Accidents, continued

(Non-North American Registered)

Date	Model	Description	Region	Phase	Operator	Fatalities
1/6/2010	CE-2086	Power loss initial climb, damaged off airport landing	Africa	Climb	Comm	No
1/14/2010	CE-2088	Power loss in cruise, aircraft damaged landing on strip	Oceania	Landing	Comm	No
1/15/2010	B-90GT	Aicraft overshot runway following takeoff abort	Europe	Takeoff	Corp	No
1/19/2010	SA-227AC	Gear failed to extend and collapsed during landing	Europe	Landing	Comm	No
1/25/2010	EMB-110	Acft. Impacted trees during 3rd app. To small field in heavy rain	S A	Approach	Comm	Yes
2/2/2010	CE-425	Total power loss on approach, aircraft landed short. night. VMC	Europe	Approach	Comm	No
3/3/2010	PA-46TPcvn	Nose gear failed to extend, aircraft landed with it retracted	Europe	Landing	Comm	No
3/28/2010	BE-200C	Aircraft landed with landing gear retracted	Landing	Comm	Comm	No
4/12/2010	DHC-6-300	Crashed attempting takeoff from a snowy, sloping stop	N.A	Takeoff	Comm	No
4/26/2010	BE-2008	Elec.failure on ILS. gear went unsafe but looked down, coil ldg.	Europe	Landing	Comm	No
4/27/2010	BE-200	Aircraft undershot NDB approach and collapsed landing gear	Europe	Approach	Comm	No
5/1/2010	PA-3IT	Runway overshoot landing. wheels stuck in sand off rwy.end	Africa	Landing	Comm	No
5/9/2010	CE-208B	Power loss in flight, off airport landing in day. VMC	Europe	Climb	Comm	No
5/10/2010	DHC-6	On landing on frozen lake, ski broke through and aircraft sank	N.A.	Landing	Comm	No
5/16/2010	DHC-3TP	Float plane landed on water with gear down and flipped over	Europe	Landing	Comm	No
5/19/2010	EMB-110	Aircraft undershot runway in fog,marginal wx and at night	S .A.	Approach	Comm	No
5/21/2010	BE-200	Aircraft dissappeared dung night flight	C.A.	Cruise	Comm	Yes
6/3/2010	SA-226TC	Aircraft veered to runway side due nose wheel sterring malf.	N.A.	Takeoff	Comm	No
6/10/2010	CE-208B	Nose gear collapsed dung landing on gravel stnp	N.A.	Landing	Comm	No
6/11/2010	CE-208	Aircraft reported missing on sightseeing flight	S.A.	Cruise	Comm	Yes
6/13/2010	CE-208	Aircraft crashed shortly after takeoff	C.A.	Climb	Comm	Yes
6/13/2010	PA-42	Takeoff aborted. runway overshoot, taus unreported	SA	Takeoff	Public	No
6/13/2010	SA-226TC	Main gear failed to extend, aircraft landed with gear retrcted	Africa	Landing	Comm	No

Appendix B

2010 Business Turbo Prop Accidents, continued

(Non-North American Registered, continued)

Date	Model	Description	Region	Phase	Operator	Fatalities
6/14/2010	SA-227	Landing gear failed to extend, aircraft Wed with gear retracted	Africa	Landing	Comm	No
6/19/2010	CASA 212	Aircraft impacted a ridge dunng flight, day. marginal weather	Africa	Cruise	Comm	Yes
6/23/2010	BE-100A	Engine failed after takeoff. aircraft crashed returning to land	N.A.	Climb	Comm	Yes
7/5/2010	BE-90E	Aircraft landed had at N'Djamena, Chad	Europe	Landing	Comm	No
7/7/2010	PA-31T	Aircraft crashed during flood survey flight. day, VMC	C.A	Maneuver	Public	Yes
7/24/2010	CE-2088	Power lost in 1kght forced beech landing, high tide dest act	N.A	Cruise	Comm	No
8/13/2010	PA-42	Aircraft veered off runway side during takeoff. gear collapsed	S.A	Takeoff	Public	No
9/5/2010	CE-208	Power lost in flight. aircraft damaged landing in a field	C.A	Landing	Comm	No
9/22/2010	BE-1008	Takeoff aborted due bird injestion in both engines, overshoot	N.A	Takeoff	Comm	No
9/30/2010	PA-31T	Pilot failed to extend landing gear poor landing	N.A	Landing	Comm	No
10/2/2010	CE-2068	Power lost in flight, aircraft damaged during forced landing	Europe	Landing	Comm	No
10/10/2010	CE-2088	Aircraft went off runway side during landing, collapsing gear	Asia	Landing	Comm	No
10/23/2010	PC-12	Aircraft landed hard bounced several times stressing airframe	Europe	Landing	Comm	No
10/25/2010	Let 410	A smuggled crocodile got loose on board, causing the crash	Africa	Cruise	Comm	Yes
10/25/2010	BE-200	Aircraft crashed on approach to Kirby Lake Airstrip, Canada	N.A.	Approach	Comm	Yes
11/4/2010	BE-C90A	Aircraft impacted terrain after control loss near St.Antonin,FR	Europe	Approach	Comm	Yes
11/5/2010	BE-1900	Aircraft crashed shortly after takeoff from Karachi Airport	Asia	Climb	Comm	Yes
11/8/2010	BE-C908	Right main gear collapsed dung normal landing, day. VMC	N.A.	Landing	Comm	No
11/15/2010	CASA 212	Aircraft struck an ice ridge landing at Antarctica	Oceania	Landing	Comm	No
11/16/2010	BE-99	1 main and nose gear failed to retract or extend, Doll. landing	N.A.	Landing	Comm	No
11/24/2010	CE-208B	Power lost on flight, nose gear collapsed landing on short strip	S.A.	Landing	Comm	No
11/26/2010	MU-2B	On landing, main gear hit deep snow, aircraft veered off runway side	N.A.	Landing	Comm	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