

**United States
Department of the Interior**



**Aviation Safety Review
Fiscal Year 02**

**Prepared by
National Business Center
Office of Aircraft Services
Aviation Safety Office
February 2003**

Published
By

United States Department of the Interior
National Business Center
Office of Aircraft Services

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During the past fiscal year, the Department of the Interior experienced an increase in aviation accidents compared to the previous year. In FY 2002, eight aircraft accidents produced a rate of 8.91 accidents per 100,000 flight hours. In FY 2001, the rate was 4.71.

Fortunately, there were no aviation-related fatalities or serious injuries in FY 2002.

This past year, Department employees and vendors continued to improve the safety environment within Interior, as reflected by increased participation in the SAFECOM (Safety Communiqué) program. We hope this trend continues!

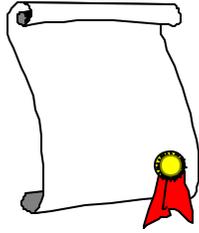
The National Transportation Safety Board (NTSB) investigated seven of the Department's accidents. The Transportation Safety Board of Canada investigated the accident in Swan River, Manitoba. The Office of Aircraft Services (OAS) participated in each of these investigations and provided assistance. To date, the NTSB has completed investigation and determined "probable cause" for four of the eight FY 2002 accidents.

We hope you find the information in this Aviation Safety Review useful. Please direct comments or suggestions to the OAS Aviation Safety Office at (208) 433-5070.

I want to personally thank personnel throughout the Department for their efforts to safely and efficiently use aviation in support of bureau missions. I would especially like to recognize and congratulate those individuals (see page ii) who received Aviation Safety Awards.

I wish everyone a safe and successful FY 2003.

/s/ Michael A. Martin
Michael A. Martin
Acting Director, Office of Aircraft Services



***Interior Aviation Safety Award
Recipients - FY 02***

In response to our request for Safety Award Nominees, the following personnel were recognized as follows:

Award for Significant Contributions to Aviation Safety

Bruce N. Collins - NPS

Airward

Robert D. Bickerstaff – BLM

Benjamin W. Hinkle - BLM

Richard N. Kemp - NPS

Charles W. Laing - BLM

William M. Tipton - NPS

U.S. Department of the Interior

Aviation Safety Review FY 02

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Section I

FY 02 Aviation Accidents

The Department of the Interior flew 89,703.4 hours at a cost of 96 million dollars during the past fiscal year and experienced an increase in aviation accidents compared to the previous year. Interior recorded eight statistically accountable aircraft accidents at an annual rate of 8.91 per 100,000 flight hours. Fortunately, there were no aviation-related fatalities or serious injuries in FY 2002.

OAS and NPS also conducted a collateral investigation(s) of a U.S. Navy helicopter accident that occurred at Yosemite National Park on June 13, 2002 in which an injured climber was killed during the hoist extraction. This event is not a DOI-reportable accident.

Interior's historical accident rate of 8.67 per 100,000 flight hours remain the same.

The National Transportation Safety Board (NTSB) investigated seven of the Department's accidents and The Transportation Safety Board of Canada (TSB) investigated one accident. The Office of Aircraft Services (OAS) participated in these investigations and provided assistance. Mishap investigations often reveal important information that may improve working conditions or mishap prevention measures. In cooperation with the NTSB, key issues associated with each accident have been identified and are included in this report. These issues are based on facts discovered during the investigations and may or may not be included in the final reports. We feel this information is important and will provide our aviation community with timely information necessary to help prevent future accidents.

The eight Interior accidents involved five airplanes and three helicopters. Pages 2 through 18 provide information about each of the mishaps.

**AIRCRAFT ACCIDENT
02-2F01-O-EGS**

AIRCRAFT DATA: Cessna A185F	DATE: October 3, 2001
BUREAU: U.S. Geological Survey	LOCATION: Houma, LA
INJURIES: One Uninjured	SOURCE: Fleet



Narrative: On October 3, 2001, at 0900 central daylight time, a Cessna A185F amphibian, N727, was substantially damaged during a hard landing at the Houma-Terrebonne Airport, Houma, Louisiana. The airplane was registered to the U.S. Department of the Interior and was operated by the U.S. Geological Survey. The commercial pilot, who was the sole occupant, was not injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the 14 Code of Federal Regulations Part 91 positioning flight. The flight departed Lafayette, Louisiana, at 0800. According to a representative from the U.S. Department of the Interior, the pilot was landing on runway 18 at Houma, when he flared too high and made a hard landing. The representative stated that one of the fuselage bulkheads sustained structural damage.

Key Issues

- Pilot flared too high
- Preflight inspections are important

Discussion

Landing in a level attitude (pitch) with power may be a more appropriate procedure for landing an amphib-configured aircraft on hard surfaced runways.

Check your aircraft thoroughly before each flight for structural damage. Especially at the rear float attach points.

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident as follows: The pilot's high flare, which resulted in a hard landing.

Contributing Factors: None.

**AIRCRAFT ACCIDENT
02-2E01-O-FWS**

AIRCRAFT DATA: Cessna 185 (Wheel)	DATE: October 5, 2001
BUREAU: U.S. Fish and Wildlife Service	LOCATION: Bethel, AK
INJURIES: Three Uninjured	SOURCE: Fleet



Narrative: On October 5, 2001, about 1750 Alaska daylight time, a wheel-equipped Cessna 185F airplane, N9344N, sustained substantial damage during landing at the Bethel Airport, Bethel, Alaska. The airplane was being operated as a visual flight rules (VFR) cross-country government flight under Title 14, CFR Part 91, when the accident occurred. The airplane was owned and operated by the U.S. Department of the Interior. The public use flight was being operated in support of a bird survey for the U.S. Fish and Wildlife Service. The certificated commercial pilot and the two passengers were not injured. Visual meteorological conditions prevailed, and a VFR flight plan was in effect. In a written statement to the National Transportation Safety Board, the pilot reported that while on approach for landing on runway 18, he encountered wind estimated to be from 230 degrees at 8 knots, which required a right crosswind correction. He added that as the main wheels touched down on the runway, the airplane did not bounce. The pilot wrote: "Upon contact of the mains, I felt a very hard pull to the right. I then applied left rudder and brake, but this was ineffective in stopping it from coming around to the right." The airplane ultimately ground looped to the right, and the left wing and left elevator struck the edge of the runway. The airplane sustained substantial damage to the left wing and left elevator. A post-accident disassembly and inspection of the accident airplane's tailwheel assembly revealed that tailwheel steering horn showed signs of wear.

Key Issues

Discussion

Pilot proficiency in aircraft configuration (tires vs floats)

This was the pilot's first flight in the aircraft since it had been reconfigured from floats to wheels. The pilot chose to take two passengers on an operational mission rather than take a more conservative (but not mandatory) approach by taking the aircraft around the traffic pattern to re-familiarize himself with its wheeled landing characteristics.

The risk of ground looping could also have been reduced if the pilot had chosen to make his first landing to the gravel runway instead of the paved runway (crosswind was essentially the same for either runway).

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident as follows: The pilot's inadequate compensation for wind conditions.

Contributing Factors: Factors associated in the accident were a crosswind, and a worn tailwheel steering horn.

**AIRCRAFT ACCIDENT
02-2F02-C-FWS**

AIRCRAFT DATA: Hughes 369D	DATE: April 11, 2002
BUREAU: U.S. Fish and Wildlife Service	LOCATION: Richland, WA
INJURIES: Four Uninjured	SOURCE: End Product (Improper)



Narrative: On April 11, 2002, approximately 1510 Pacific daylight time, a Hughes 369D, N8353F, operated by the U.S. Fish and Wildlife Service as a public use aerial animal capture operation, was substantially damaged when a weight from the net separated and contacted a main rotor blade. The operation was being conducted about seven miles north of Richland, Washington. Visual meteorological conditions prevailed at the time and a visual flight rules flight plan was filed. The commercial pilot, the gunner (net gun shooter) and two muggers (animal capture ground support) were not injured. During the aerial animal capture flight, the helicopter was positioned about 15 feet above ground level over the elk for capture. The pilot positioned the helicopter to get the gunner into firing position and told the gunner to get ready. When ready, the gunner fired the net. Immediately after the shot, a loud bang was heard and the helicopter began to vibrate. The pilot landed the helicopter without further incident. After the main rotor blades stopped turning, it was noted that one of the blades had a hole on the leading edge that exposed the spar. Additional holes were noted on the back of the blade about two inches from the trailing edge. The net that was discharged was examined. It was noted that one of the net weights from one of the four corners was missing and had separated from the attaching material. The weight was later found about 300 feet from the net and displayed impact damage and was slightly bent.

Key Issues

Discussion

- Risk Management Strengths

Very experienced crew.

Pilot flew as conservative a profile as possible.

Very good crew coordination.

- Risk Management Weaknesses

Lack of standards for gunner training.

Gunners are not carded.

Last minute mission request and lack of understanding of policy requirements resulted in the flight being conducted as a flight services contract rather than an end-product contract (government assumed operational control).

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident as follows: Failure of the netting material securing a net weight while maneuvering.

Contributing Factors: The net weight was a factor.

Note: Inspection of the net assembly by the OAS investigator identified failure to the net webbing and to the lanyard that attaches the net to the weight.

A single point of failure in tension, of either the lanyard or the netting, would be consistent with a material weakness. A single point failure would result in either the lanyard failing and the netting remaining intact, or the netting failing and the lanyard remaining intact.

**AIRCRAFT ACCIDENT
02-2E02-A-EGS**

AIRCRAFT DATA: Robinson R-44	DATE: May 16, 2002
BUREAU: U.S. Geological Survey	LOCATION: Cantwell, AK
INJURIES: Three Uninjured	SOURCE: ARA



Narrative: On May 16, 2002, about 1230 Alaska daylight time, a Robinson R-44 helicopter, N344AK, sustained substantial damage while maneuvering near trees, about 23 miles southwest of Cantwell, Alaska. The helicopter was being operated as a visual flight rules (VFR) public use government flight when the accident occurred. The commercial certificated pilot and the two passengers were not injured. Visual meteorological conditions prevailed. A VFR flight plan was filed. The helicopter was being utilized by the U.S. Geological Survey to track caribou. The area of the accident was in the Denali National Park boundary. The pilot reported that he was maneuvering the helicopter in an attempt to move radio-collared caribou out of an area of trees along the west fork of the Chulitna River. Prior to beginning the maneuvering, the pilot said he conducted a hover power check, and was satisfied with the helicopter's available power. He then began to hover near several caribou. The pilot said that when he raised the collective control to move from his hover position, the low rotor annunciator sounded. He said he did not have sufficient power available to climb away from his position, and the helicopter began to settle toward the ground. One of the helicopter landing gear skids settled into low bushes, and the pilot was able to regain sufficient rotor RPM to move to a nearby landing area. After landing, the pilot found that one of the main rotor blades had a tear in the bottom surface of the blade surface. The other main rotor blade had several dents. He said he did not feel any rotor contact with the trees.

Key Issues

- Performance Planning

- Performance Planning – Power Required

Discussion

Maximum gross weight of the R-44 is 2,400 pounds.

Planned operating weight was 2,396.35 pounds. (3.65 pounds to spare).

Are we accepting necessary (or unnecessary) risk when we chose to operate this close to the limit?

In the operating environment (2000" PA/10°C) the maximum continuous power was limited to 23.4" Hg.

Power check indicated 24.1" Hg. required for HOGE.

Pilot chose to use the maximum T/O power limitation (5 minute limit) by adding 1.6" Hg. for a total of 25" Hg.

Are we accepting necessary (or unnecessary) risk when we chose to operate this close to the limit?

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident as follows: A failure of the pilot-in-command to maintain adequate main rotor rpm during an out-of-ground-effect hover.

Contributing Factors: None.

**AIRCRAFT ACCIDENT
02-2F03-O-FWS**

AIRCRAFT DATA: Cessna TU206F	DATE: May 27, 2002
BUREAU: U.S. Fish and Wildlife Service	LOCATION: Swan River, Manitoba, Canada
INJURIES: One Minor, One Uninjured	SOURCE: Fleet



Narrative: The amphibious Cessna TU206F, N753 operated by the United States Department of the Interior, had just taken off from runway 20 at Swan River when the pilot felt the engine begin to vibrate and noticed the manifold pressure slowly and progressively decreasing. The pilot turned downwind to return to the airport, but was unable to maintain altitude and performed a forced landing about one mile west of the airport. The aircraft was destroyed in a post-impact fire. The pilot sustained minor injuries and the second crewmember was not injured.

Key Issues

Discussion

- Crew Resource Management

The pilot did not request assistance during the emergency.

The passenger, seated in the right front seat, was carded and qualified in the aircraft.

The passenger did not offer assistance to the pilot during the emergency.

- Situational Awareness

Runway 20 at Swan River Airport, was 4130 feet in length.

Witness reported aircraft took off in the first one-third of the runway.

More than one-half mile of runway plus another 1000 feet of pasture remained available to the pilot.

- Pilot and passenger were not wearing personal protective equipment

Pilot was not wearing a flight helmet or gloves and suffered first-degree burns on his hand during the egress.

Helmets and gloves were stowed in the back of the aircraft.

- Critical checklist items were not completed

Improper Procedure: Pilot did not retract the landing gear in accordance with the Takeoff and the Emergency Landing checklists.

- The accident reporting hotline number was improperly used for flight plan point-of-contact number.

OPM 02-02 requires flight plans and flight following.

The accident reporting hotline number is designed for reporting aircraft accidents.

The accident reporting hotline number does not work in Canada.

The accident is under investigation by the Transportation Safety Board of Canada (TSB); preliminary information is subject to change.

**AIRCRAFT ACCIDENT
02-2E03-O-FWS**

AIRCRAFT DATA: Cessna 185 (Wheel/Ski)	DATE: June 7, 2002
BUREAU: U.S. Fish and Wildlife Service	LOCATION: Kaktovik, AK
INJURIES: Two Uninjured	SOURCE: Fleet



Narrative: On June 7, 2002, about 1815 Alaska daylight time, a wheel/ski-equipped Cessna 185 airplane, N749, sustained substantial damage during the landing roll on a remote, ice-covered lake, about 45 miles southwest of Kaktovik, Alaska. The airplane was being operated as a visual flight rules local area public use flight when the accident occurred. The commercial certificated pilot and the sole passenger were not injured. Visual meteorological conditions prevailed. VFR flight following procedures were in effect. During a telephone conversation with the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) a Federal Aviation Administration inspector, Fairbanks Flight Standards District Office (FSDO), reported that the operator was requesting a ferry permit to move the airplane from the accident site to Fairbanks. The inspector said the airplane needed to be moved off a frozen lake that was beginning to thaw. During a telephone conversation with the NTSB IIC, on June 10, an investigator with the U.S. Department of Interior, Office of Aircraft Services, reported that the pilot was landing on a remote lake at the conclusion of a caribou tracking flight. The pilot landed with the skis extended, and began sliding on the icy surface toward an area of open water. The investigator reported that the pilot initiated a left turn and applied engine power. The airplane's right wing and right elevator struck the ice. The airplane received damage to the right wingtip, right aileron, and the right elevator.

Key Issues

- Aircraft damage was repaired and the aircraft was moved to Fairbanks in violation of 49 CFR 830.10.
- Pilot landed to the west with a 5-7 knot tailwind.
- Pilot configured the aircraft for landing using skis.
- Once the pilot realized he was not going to be able to stop he elected not to execute a go-around

Discussion

Title 49 CFR 830.10 – “The operation of an aircraft involved in an accident...is responsible for preserving

the extent possible any wreckage, cargo, and mail aboard the aircraft and all records...until the Board takes custody thereof or a release is granted pursuant to 831.12b of this chapter.”

Pilot mistakenly thought he was landing into the wind, which had been out of the west during earlier takeoff and landings.

A subsequent change in wind direction was not detected by the pilot resulting in a downwind landing.

Would a wheel landing have been a better choice, allowing the pilot to use brakes to slow the aircraft?

Would planning for, and executing, a go-around have prevented this accident?

The accident is under investigation by the NTSB; preliminary information is subject to change.

**AIRCRAFT ACCIDENT
02-2F05-A-FNP**

AIRCRAFT DATA: Bell 206B-III	DATE: June 25, 2002
BUREAU: National Park Service	LOCATION: Mt. Rainier NP, WA
INJURIES: Three Uninjured	SOURCE: ARA



Narrative: On June 25, 2002, at 1556 Pacific daylight time, a Bell 206B, N1087L, operated by the National Park Service as a public use flight, collided with the terrain on Mt. Rainier, Rainier, Washington. Visual meteorological conditions prevailed and a company visual flight rules flight plan was filed. The helicopter was substantially damaged and the commercial pilot and two passengers were not injured. The pilot reported that the purpose of the flight was to pickup and transport mountain rescue personnel to aid an injured climber on Mt. Rainier's Carbon Glacier. The pilot arrived at the Kautz Helibase about 1400 for a briefing and to pick up one of the rescue personnel. The flight departed from Kautz Helibase at 1518 and arrived at Camp Schurman about 20 minutes later to pick up the second rescuer. The flight then departed to the Carbon Glacier. The pilot reported that he made several passes over possible landing sites as well as checking aircraft performance. One attempt to land was aborted as the terrain was too steep. The pilot then maneuvered to a lower and flatter site. After landing, the climbing party asked the pilot to reposition to a more stable surface. The pilot stated that he took off and moved up the draw, monitoring power requirements as he went. The pilot set the helicopter down on the snow and slowly lowered the collective and checked for compaction of the snow under the skids. The pilot stated that he was on the snow about 8 to 10 seconds with the collective almost down when the helicopter suddenly pitched and began to shake. The pilot stated that he thought that he reached a droop stop limit and reacted by moving the cyclic forward and raising collective. The helicopter lifted off and climbed to about 20 feet and yawed to the right. The pilot reported that he had no tail rotor authority and lowered the collective and settled back to the ground. The helicopter landed upright pointing down hill. The tail boom broke and was bent forward.

Key Issues

- Risk Management Strengths
- Risk Management Weaknesses
This
Pilot Qualification and Experience
- Risk Management Weaknesses
Crew Qualification and Experience
- Risk Management Weaknesses
Culture
- Risk Management Weaknesses
General

Discussion

Involved Park leadership.

Weighed the risks of ground vs. air evacuation.

Appropriate sense of urgency.

Pro-active training program.

Excellent post-accident response actions and recovery planning.

The pilot was not carded to fly for this vendor.

error was not identified by the pilot, the vendor, or the HEMG.

The pilot was not carded for snow operations. The lack of a standard definition for “deep snow” may have contributed to this accident.

Four of six OAS-64’s had erroneous flight time histories.

This mission was too complex for a pilot’s first flight to Mt. Rainier.

Periodic joint training between vendor pilots, vendor guides, and Park Employees may have precluded communication and crew resource management failures.

Vendor climbing guides who participate in Park aviation missions do not receive aviation training (i.e. Basic Aviation Safety training – B3).

The mishap pilot was under self-induced pressure to accept the mission because the company’s other two pilots routinely performed this same type of mission.

The helicopter manager did not act on warnings offered by the Army helicopter crew.

Senior Park Managers, knowing that the second set of rescuers were not hoist qualified, decided that landing a Bell 206BIII on the glacier was less risky than hoisting with a CH-47.

Passengers did not wear proper personal protective equipment (PPE) and did not have a waiver to DOI PPE requirements.

The passenger briefing for the mishap flight was not adequate.

Key aviation personnel were out of the Park on fire/law enforcement assignments and less experienced (but qualified) personnel were filling in.

The accident is under investigation by the NTSB; preliminary information is subject to change.

**AIRCRAFT ACCIDENT
02-2F06-C-LLM**

AIRCRAFT DATA: WSK PZL Mielec M-18A	DATE: July 7, 2002
BUREAU: Bureau of Land Management	LOCATION: Fillmore, UT
INJURIES: One Minor	SOURCE: Exclusive Use Contract



Narrative: On July 7, 2002, approximately 1830 mountain daylight time, a WSK PZL Mielec M-18A, N5198Y, operated as a public use aircraft by the U.S. Department of Interior, Boise, Idaho, was destroyed when it impacted terrain while maneuvering shortly after taking off from Fillmore, Utah Airport. The commercial pilot, the sole occupant aboard, received minor injuries. Day visual meteorological conditions prevailed, and a BLM-approved flight plan had been filed for the fire suppression flight being operated as a public use aircraft. The flight originated at Fillmore, Utah, approximately 1827. The airplane, operating as "Tanker 450," departed Fillmore Airport's runway 22 and turned east at 300 feet agl (above ground level). The pilot was unable to maintain altitude and he delayed jettisoning the retardant load. When the airplane was in a position to jettison the load, the pilot discovered the jettison switch guard was in the closed position. While attempting to remove the guard, the right wingtip scraped the ground, then the airplane struck the ground with its landing gear and spun around before coming to a halt. The landing gear was torn off, and both wings and the fuselage were buckled. The retardant had a "very thick consistency." A sample

of the retardant, removed from the sealed pump hose, was submitted to Wildland Fire Chemical Systems for testing. The sample was determined to be LCA-R (concentrated retardant unmixed with water). No water was found in the sample. The sample weighed 12.2 pounds per gallon, slightly heavier than pure concentrate (12.1 pounds per gallon). OAS investigators said this might have been due to the failure of the operators to recycle the concentrate as recommended by the manufacturer. Their investigation revealed that the water and retardant valves were working properly and should have delivered a proper water-retardant mix if they had been set correctly. They concluded the water valve was in the full closed position during the mixing process.

Key Issues

Discussion

- Risk Management Strengths

Excellent post-accident involvement by all levels of Bureau leadership.

Immediate, fleet-wide corrective actions.

Pro-active training program by BLM’s National SEAT Program Manager.

Excellent post-accident response and reporting.

- Risk Management Weaknesses

SEAT Manager (SEMG)

Information (policy) dissemination for seasonal employees needs to be improved.

After the loader called in sick the SEMG allowed the aircraft to remain on contract without contacting the Contracting Officer.

The SEMG and vendor crew failed to comply with the manufacturer’s recommendations for recirculating the retardant and for using the refractometer.

The SEMG and the pilot failed to notice the water valve was closed.

- Risk Management Weaknesses

Vendor Responsibilities

The vendor failed to adequately train his personnel.

Should vendor personnel who are not adequately trained be allowed on contract?

Should loaders be evaluated and carded since their actions directly affect aviation safety?

The company owner told the pilot and loader to get training from the SEMG. The responsibility for training vendor employees rests with the vendor, not the government.

- Risk Management Weaknesses

Pilot Performance

The pilot was not adequately trained.

Should performance planning similar to helicopter load calculations be required for SEAT operations?

The pilot failed to release all, or part, of his load due to lack of training and inexperience.

The pilot failed to properly set the retardant system’s water valve.

Key Issues

- Risk Management - Weaknesses

Discussion

The M-18 Pilot Operating Handbook's performance charts do not cover all the temperature we operate in. Therefore, calculation of aircraft performance was not possible in this case.

Variation in cockpit design and switch location increases the risk of negative habit transfer.

The accident is under investigation by the NTSB; preliminary information is subject to change.

Section II

FY 00, and FY 01 Aviation Accidents - Follow-up

At the time the Annual Safety Review is published each year many accidents have not yet been finalized by the National Transportation Safety Board (NTSB). To complete the information flow, the following material pertains to accidents presented in the FY00 and FY01 Aviation Safety Review.

AIRCRAFT ACCIDENT 00-0F04-C-LLM

AIRCRAFT DATA: Bell 412	DATE: August 13, 2000
BUREAU: Bureau of Land Management	LOCATION: Cold Springs, NV
INJURIES: One Fatal	SOURCE: Contract

Narrative: On August 13, 2000, at 1646 hours Pacific daylight time, a Bell 412, N174EH, collided with mountainous terrain while conducting a water drop on a wildfire along a ridgeline near Cold Springs, Nevada. The helicopter was operated by the Bureau of Land Management as a public-use firefighting mission under the provisions of 14 CFR Part 91, and was destroyed. The airline transport pilot sustained fatal injuries. Visual meteorological conditions prevailed for the accident flight, and a company flight plan was filed. The helicopter had departed the Twin Peaks Helibase located at Cold Springs at 1605. Weather reported by another firefighting pilot who was flying in the area at the time of the accident was about 79 degrees Fahrenheit, with winds from the north-northwest at 10-15 knots. The accident site elevation was about 6,300 feet msl. An approximate density altitude of 9,100 feet was calculated for the accident location. The accident helicopter was the lead in a flight of two helicopters that was to make a bambi bucket water drop along the ridgeline, at his discretion, with the trailing pilot also making a water drop behind the accident helicopter.

The accident is currently under investigation by the NTSB; preliminary information is subject to change.

**AIRCRAFT ACCIDENT
01-1F04-C-LLM**

AIRCRAFT DATA: Aero Commander 500	DATE: August 21, 2001
BUREAU: Bureau of Land Management	LOCATION: Elko, NV
INJURIES: Three Uninjured	SOURCE: Contract

Narrative: On August 21, 2001, at 1503 hours Pacific daylight time, an Aero Commander 500, N975AA, had both main landing gear collapse on landing at Elko, Nevada. Avcenter, Inc., was operating the airplane as a public-use fire command and control flight under the provisions of 14 CFR Part 91. The commercial pilot and two passengers were not injured; the airplane sustained substantial damage. The local flight departed Elko about 1330. Visual meteorological conditions prevailed, and a company VFR flight plan had been filed. The operator reported that the airplane touched down and began its landing roll. About 100 feet down the runway, both main landing gear collapsed. The resulting skid ground off the belly skin and damaged several structural airframe components. One of the observers in the airplane was also a pilot. He observed three green landing gear lights, and told the operator that he and the pilot both visually checked that the landing gear was down. He observed the pilot maintain one hand on the control yoke and the other on the throttle throughout the landing and landing roll.

The accident is currently under investigation by the NTSB; preliminary information is subject to change.

Section III

Accident Statistics and Trends - Introduction

This section of the review presents a statistical overview of aviation accidents, incidents, and flight times within the Department of the Interior (DOI). Whenever possible, total flight times and accidents are subdivided into fleet, contract, and rental aircraft. Historical records from previous years are also included for comparison.

The statistics are divided into two major parts. The first reflects DOI accident history and rates from FY 75 to FY 02. Several comparisons are presented using data collected from FY 98 through FY 02. The last section reviews events reported through the SAFECOM reporting system.

All accident rates in this report are based on 100,000 flight hours. They are determined by dividing the number of accidents by the flight hours, then multiplying that number by 100,000. The historical average is determined by dividing the total number of accidents by the total flight hours recorded since FY 75, then multiplying that number by 100,000.

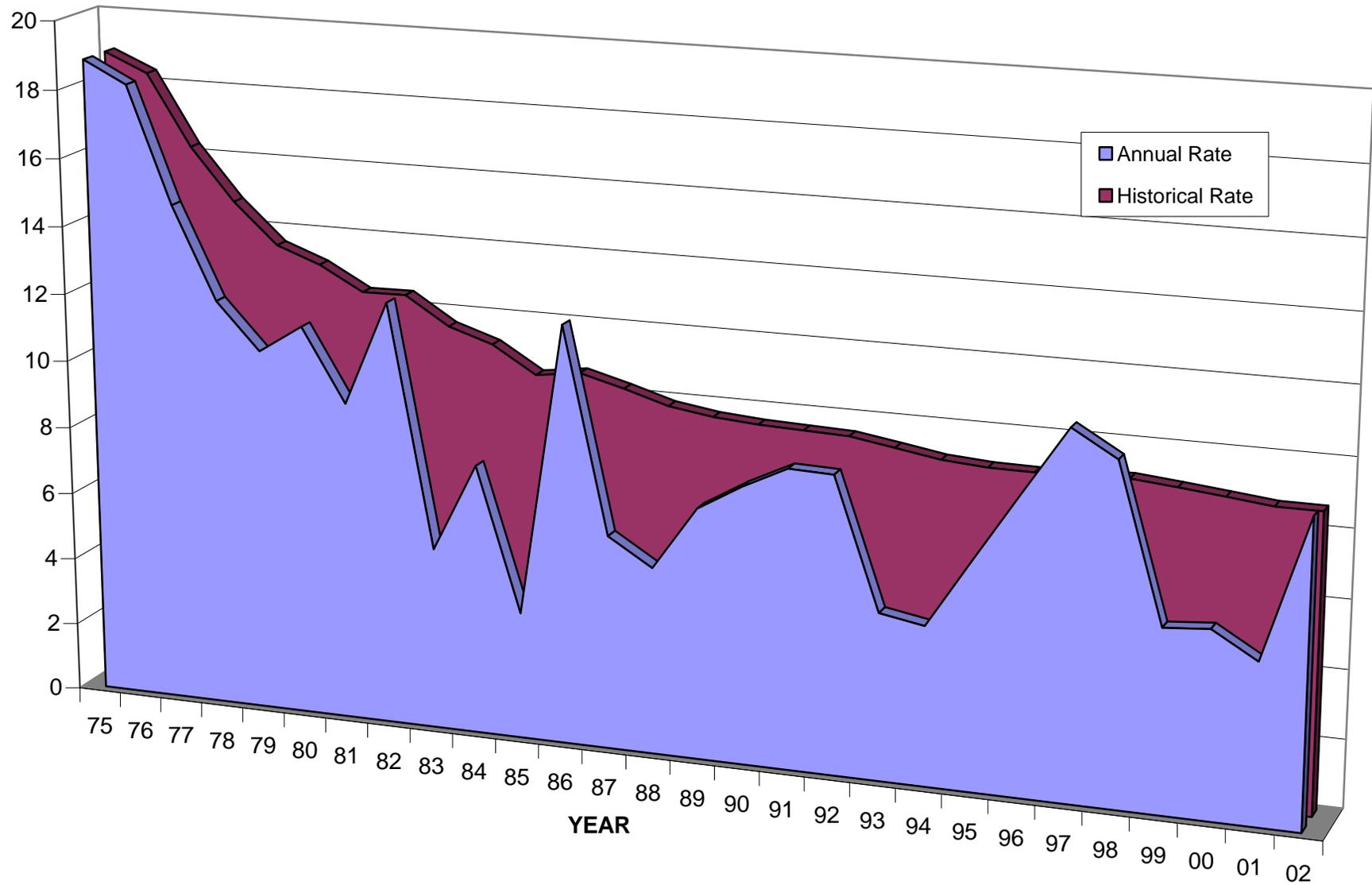
Historical Records from FY 75 to FY 02

In FY 02 the Department of the Interior flew 89,703.4 hours. Interior recorded eight statistically accountable aircraft accidents for an annual rate of 8.91 per 100,000 flight hours.

Graph 1/Table 1	ACCIDENT RATE HISTORY. A comparison of annual and historical accident rates from FY 75 through FY 02
Graph 2/Table 2	TOTAL FLIGHT HOURS. A comparison of annual flight hours, which are subdivided according to the source (Fleet, Rental, and Contract). The historical column reflects cumulative flight times.
Graph 3/Table 3	FATAL ACCIDENT RATE HISTORY. A summary of annual and historical rates from FY 75 through FY 02
Graph 4/Table 4	FATALITY RATE HISTORY. A comparison of annual and historical fatality rates from FY 75 through FY 02
Graph 5/Table 5	BUREAU FLIGHT HOURS. A comparison of bureau flight hours for FY 02 BUREAU STATISTICS. Bureau flight hours and accidents from FY 98 to FY 02
Graph 6	SOURCE COMPARISONS. A comparison of flight hours, accidents, and accident rates by source (Fleet, Rental, and Contract) from FY 98 to FY 02
Graph 7	AIRCRAFT COMPARISONS. A comparison of airplane and helicopter accidents and accident rates from FY 98 to FY 02 Graph 7a - AIRPLANE PHASE OF FLIGHT COMPARISONS. A comparison of number of airplane accidents per phase of flight FY 98 to FY 02 Graph 7b- HELICOPTER PHASE OF FLIGHT COMPARISONS. A comparison of number of helicopter accidents per phase of flight from FY 98 to FY 02
Graph 8	FATAL ACCIDENT COMPARISONS. A comparison of airplane and helicopter fatal accidents and fatal accident rates from FY 98 to FY 02

ACCIDENT RATE HISTORY

RATE



	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
■ Annual Rate	18.87	18.22	14.81	12.10	10.73	11.57	9.41	12.49	5.36	7.96	3.73	12.30	6.29	5.50	7.37	8.14	8.78	8.74	4.91	4.68	6.72	8.73	10.71	9.95	5.37	5.48	4.71	8.91
■ Historical Rate	18.87	18.32	16.25	14.73	13.56	13.09	12.39	12.41	11.60	11.19	10.41	10.59	10.25	9.86	9.68	9.58	9.53	9.49	9.28	9.07	8.98	8.97	9.03	9.06	8.94	8.81	8.67	8.67

Graph 1

ACCIDENT RATE HISTORY

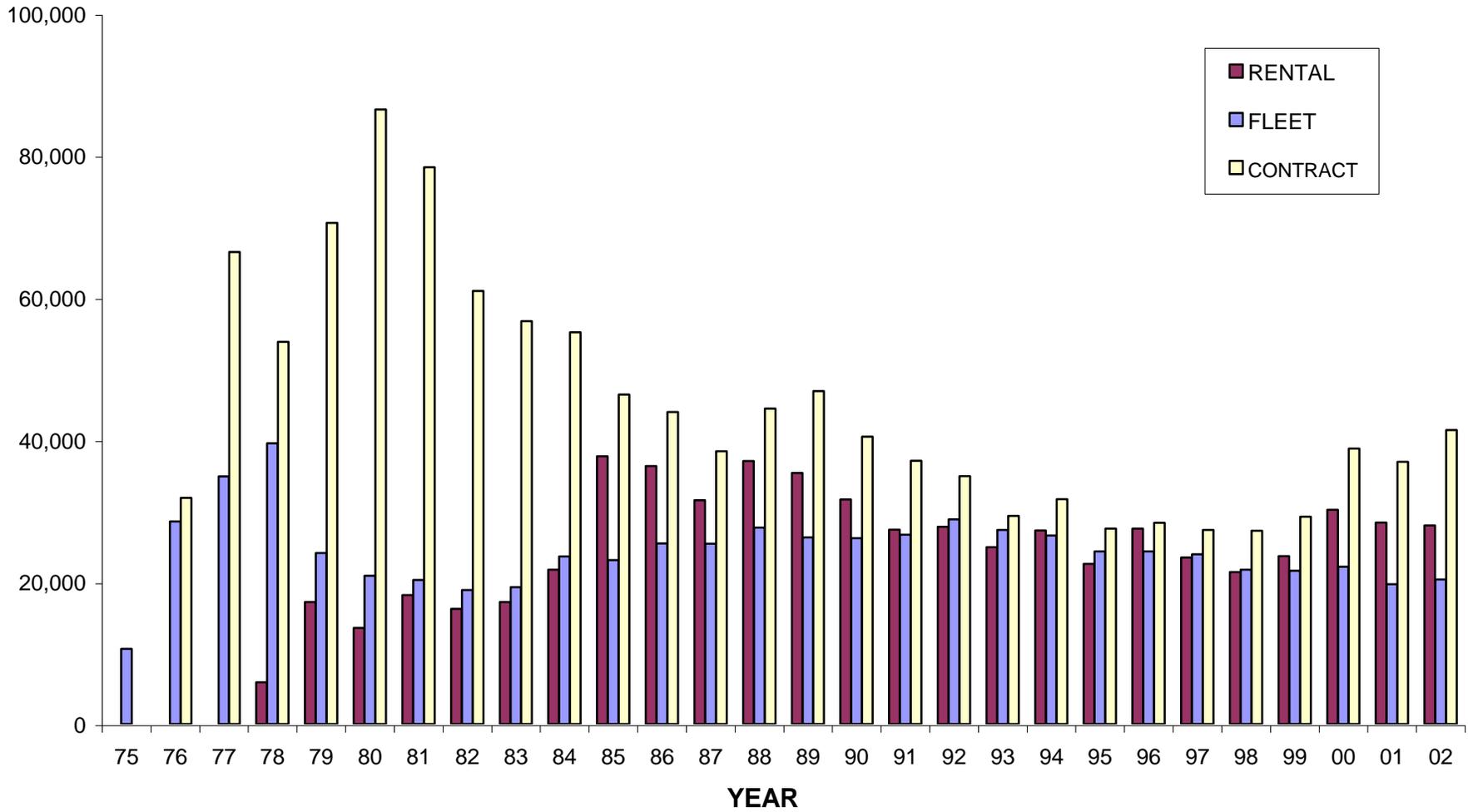
Year	Rental		Fleet		Contract		Total (Annual)			Total (Historical)		
	Accident	Rate	Accident	Rate	Accident	Rate	Accident	Accident *	Rate	Accident	Accident*	Rate
75	0	0.00	2	18.87	n/a**	n/a	2	4	18.87	2	4	18.87
76	0	0.00	3	10.51	8	25.13	11	7	18.22	13	11	18.32
77	0	0.00	4	11.47	11	16.56	15	4	14.81	28	15	16.25
78	0	0.00	4	10.12	8	14.87	12	2	12.10	40	17	14.73
79	1	5.82	3	12.46	8	11.34	12	6	10.73	52	23	13.56
80	0	0.00	6	28.75	8	9.24	14	2	11.57	66	25	13.09
81	1	5.50	1	4.92	9	11.48	11	1	9.41	77	26	12.39
82	1	6.16	6	31.79	5	8.20	12	1	12.49	89	27	12.41
83	1	5.81	0	0.00	4	7.06	5	1	5.36	94	28	11.60
84	2	9.20	1	4.23	5	9.06	8	2	7.96	102	30	11.19
85	1	2.65	1	4.32	2	4.31	4	4	3.73	106	34	10.41
86	2	5.51	4	15.72	7	15.94	13	3	12.30	119	37	10.59
87	0	0.00	3	11.80	3	7.81	6	0	6.29	125	37	10.25
88	3	8.10	2	7.23	1	2.25	6	0	5.50	131	37	9.86
89	3	8.48	2	7.61	3	6.40	8	2	7.37	139	39	9.68
90	5	15.82	1	3.82	2	4.94	8	0	8.14	147	39	9.58
91	6	21.93	2	7.50	0	0.00	8	1	8.78	155	40	9.53
92	0	0.00	8	27.74	0	0.00	8	0	8.74	163	40	9.49
93	2	8.04	1	3.66	1	3.41	4	2	4.91	167	42	9.28
94	1	3.67	2	7.53	1	3.16	4	0	4.68	171	42	9.07
95	3	13.30	1	4.11	1	3.63	5	1	6.72	176	43	8.98
96	2	7.26	4	16.46	1	3.53	7	0	8.73	183	43	8.97
97	2	8.52	4	16.73	2	7.32	8	0	10.71	191	43	9.03
98	2	9.34	2	9.20	3	11.02	7	1	9.95	198	44	9.06
99	1	4.22	1	4.63	2	6.84	4	1	5.37	202	45	8.94
00	2	6.62	1	4.51	2	5.15	5	0	5.48	207	45	8.81
01	0	0.00	3	15.23	1	2.70	4	0	4.71	211	45	8.67
02	2	7.15	4	19.65	2	4.83	8	0	8.91	219	45	8.67
Total	43	6.78	76	10.88	100	8.38	219	45	8.67			

* Non-Chargeable accidents

** Contract flight hours not available in 1975.

TOTAL FLIGHT HOURS

HOURS



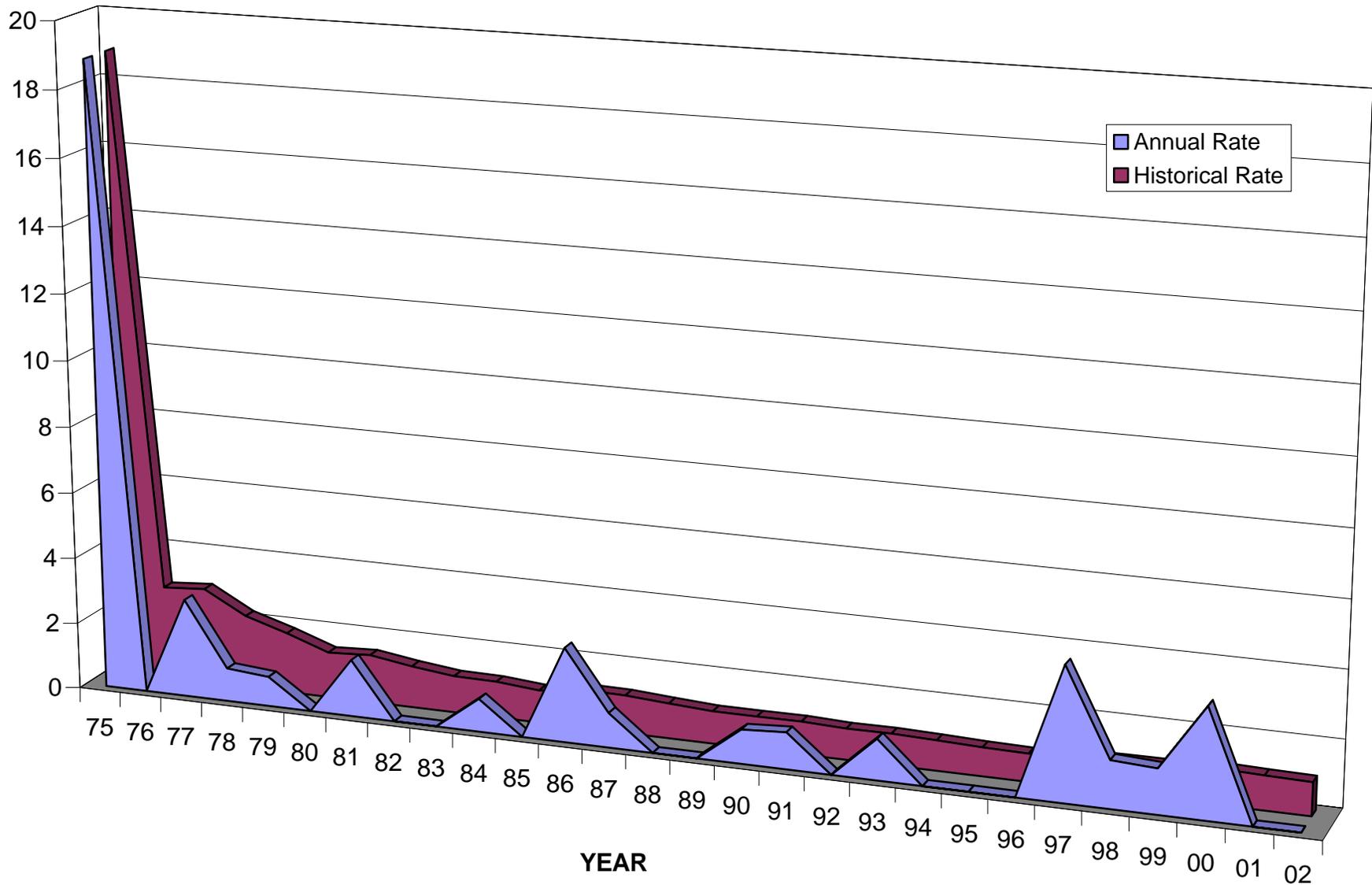
TOTAL FLIGHT HOURS

Year	Rental	Fleet	Contract	Total (Annual)	Total (Historical)
75	0.0	10,598.8	n/a*	10,598.8	10,598.8
76	0.0	28,523.4	31,833.4	60,356.8	70,955.6
77	0.0	34,865.2	66,442.1	101,307.3	172,262.9
78	5,890.0	39,528.1	53,784.9	99,203.0	271,465.9
79	17,180.8	24,072.7	70,528.1	111,781.6	383,247.5
80	13,551.9	20,865.6	86,515.1	120,932.6	504,180.1
81	18,173.0	20,284.4	78,381.5	116,838.9	621,019.0
82	16,223.5	18,876.4	60,953.0	96,052.9	717,071.9
83	17,193.1	19,286.5	56,694.9	93,174.5	810,246.4
84	21,727.4	23,605.8	55,143.1	100,476.3	910,722.7
85	37,686.3	23,095.5	46,396.4	107,178.2	1,017,900.9
86	36,321.0	25,431.7	43,909.8	105,662.5	1,123,563.4
87	31,514.7	25,408.9	38,397.4	95,321.0	1,218,884.4
88	37,036.9	27,667.3	44,401.7	109,105.9	1,327,990.3
89	35,357.9	26,283.9	46,853.0	108,494.8	1,436,485.1
90	31,603.4	26,188.2	40,462.7	98,254.3	1,534,739.4
91	27,360.9	26,660.7	37,051.5	91,073.1	1,625,812.5
92	27,763.2	28,834.8	34,885.9	91,483.9	1,717,296.4
93	24,890.4	27,317.2	29,288.6	81,496.2	1,798,792.6
94	27,240.4	26,533.5	31,640.8	85,414.7	1,884,207.3
95	22,547.1	24,325.7	27,514.6	74,387.4	1,958,594.7
96	27,530.4	24,300.7	28,328.9	80,160.0	2,038,754.7
97	23,462.5	23,895.7	27,313.0	74,671.2	2,113,425.9
98	21,415.8	21,734.9	27,227.2	70,377.9	2,183,803.8
99	23,645.6	21,573.6	29,205.5	74,424.7	2,258,228.5
00	30,171.6	22,137.6	38,787.7	91,096.9	2,349,325.4
01	28,374.2	19,694.3	36,907.5	84,976.0	2,434,301.4
02	27,965.9	20,355.9	41,381.6	89,703.4	2,524,004.8
Total	631,827.9	681,947.0	1,210,229.9	2,524,004.8	

* Contract flight hours not available in 1975.

FATAL ACCIDENT RATE HISTORY

RATE



	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
■ Annual Rate	18.87	0.00	2.96	1.00	0.89	0.00	1.71	0.00	0.00	0.99	0.00	2.84	1.04	0.00	0.00	1.02	1.10	0.00	1.23	0.00	0.00	0.00	4.01	1.42	1.34	3.29	0.00	0.00
■ Historical Rate	18.87	2.81	2.90	2.21	1.83	1.38	1.45	1.26	1.11	1.09	0.98	1.16	1.14	1.05	0.97	0.98	0.98	0.93	0.94	0.90	0.86	0.83	0.94	0.96	0.97	1.06	1.02	0.99

Graph 3

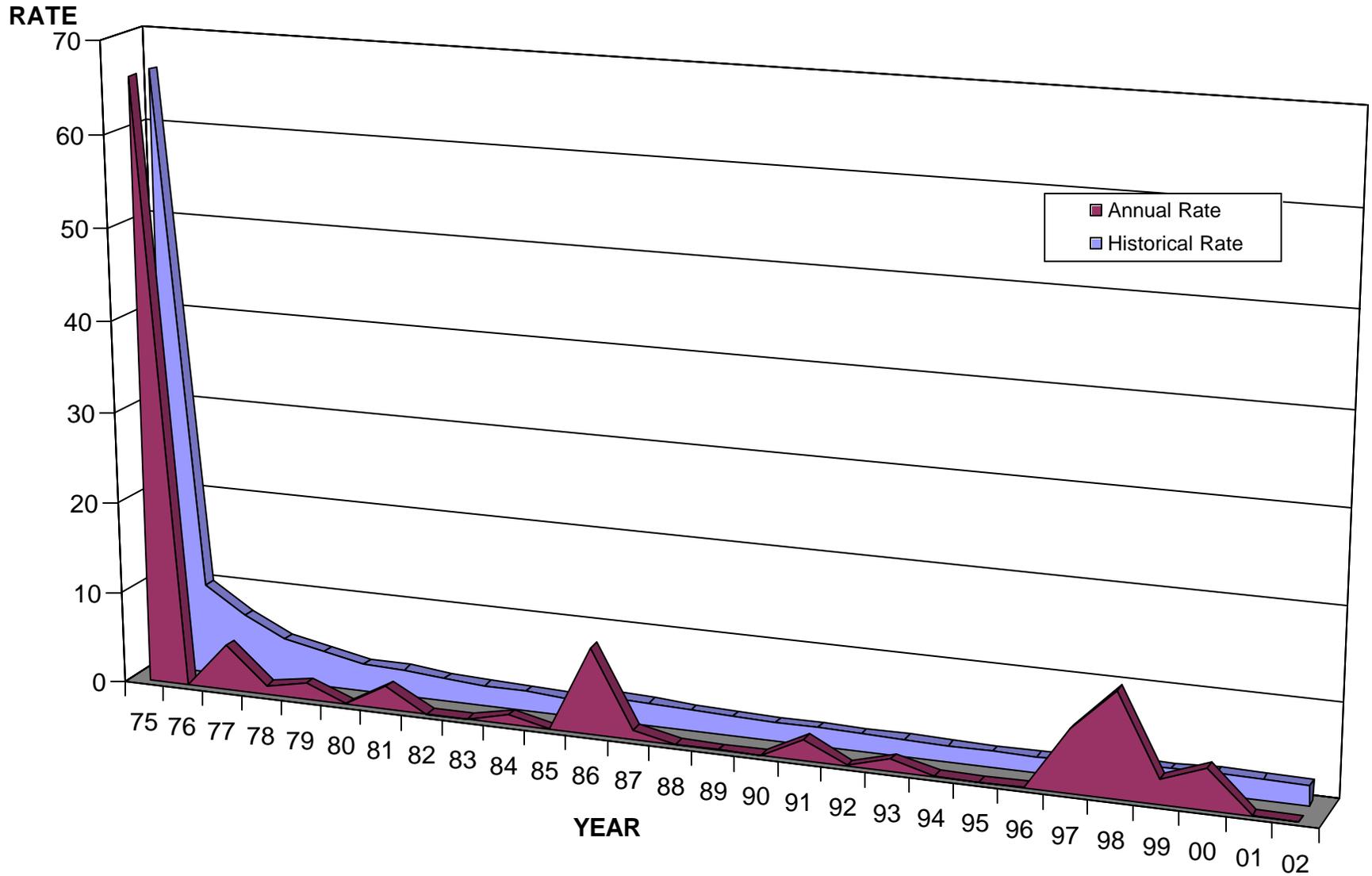
FATAL ACCIDENT RATE HISTORY

Year	Rental		Fleet		Contract		Total (Annual)			Total (Historical)		
	Accident	Rate	Accident	Rate	Accident	Rate	Accident	Accident *	Rate	Accident	Accident *	Rate
75	0	0.00	2	18.87	0	n/a**	2	1	18.87	2	1	18.87
76	0	0.00	0	0.00	0	0.00	0	3	0.00	2	4	2.81
77	0	0.00	0	0.00	3	4.51	3	0	2.96	5	4	2.90
78	0	0.00	1	2.53	0	0.00	1	1	1.00	6	5	2.21
79	0	0.00	1	4.15	0	0.00	1	0	0.89	7	5	1.83
80	0	0.00	0	0.00	0	0.00	0	2	0.00	7	7	1.38
81	0	0.00	0	0.00	2	2.55	2	0	1.71	9	7	1.45
82	0	0.00	0	0.00	0	0.00	0	0	0.00	9	7	1.26
83	0	0.00	0	0.00	0	0.00	0	0	0.00	9	7	1.11
84	1	4.60	0	0.00	0	0.00	1	1	0.99	10	8	1.09
85	0	0.00	0	0.00	0	0.00	0	1	0.00	10	9	0.98
86	1	2.75	0	0.00	2	4.55	3	0	2.84	13	9	1.16
87	0	0.00	0	0.00	1	2.60	1	0	1.04	14	9	1.14
88	0	0.00	0	0.00	0	0.00	0	0	0.00	14	9	1.05
89	0	0.00	0	0.00	0	0.00	0	0	0.00	14	9	0.97
90	1	3.16	0	0.00	0	0.00	1	0	1.02	15	9	0.98
91	1	3.65	0	0.00	0	0.00	1	0	1.10	16	9	0.98
92	0	0.00	0	0.00	0	0.00	0	0	0.00	16	9	0.93
93	1	4.02	0	0.00	0	0.00	1	2	1.23	17	11	0.94
94	0	0.00	0	0.00	0	0.00	0	0	0.00	17	11	0.90
95	0	0.00	0	0.00	0	0.00	0	1	0.00	17	12	0.86
96	0	0.00	0	0.00	0	0.00	0	0	0.00	17	12	0.83
97	0	0.00	1	4.18	2	7.32	3	0	4.01	20	12	0.94
98	1	4.67	0	0.00	0	0.00	1	0	1.42	21	12	0.96
99	1	4.22	0	0.00	0	0.00	1	0	1.34	22	12	0.97
00	1	3.31	0	0.00	2	5.15	3	0	3.29	25	12	1.06
01	0	0.00	0	0.00	0	0.00	0	0	0.00	25	12	1.02
02	0	0.00	0	0.00	0	0.00	0	0	0.00	25	12	0.99
Total	8	1.26	5	0.73	12	0.99	25	12	0.99			

* Non-chargeable fatal accidents.

** Contract flight hours not available in 1975.

FATALITY RATE HISTORY



	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
Annual Rate	66.0	0.00	4.94	1.00	1.79	0.00	2.56	0.00	0.00	0.99	0.00	9.46	1.04	0.00	0.00	0.00	2.20	0.00	1.23	0.00	0.00	0.00	6.69	11.3	2.68	4.39	0.00	0.00
Historical Rate	66.0	9.87	6.97	4.79	3.91	2.98	2.89	2.51	2.22	2.08	1.86	2.58	2.46	2.26	2.09	1.95	1.97	1.86	1.83	1.75	1.68	1.62	1.80	2.11	2.12	2.21	2.13	2.06

Graph 4
Page 28

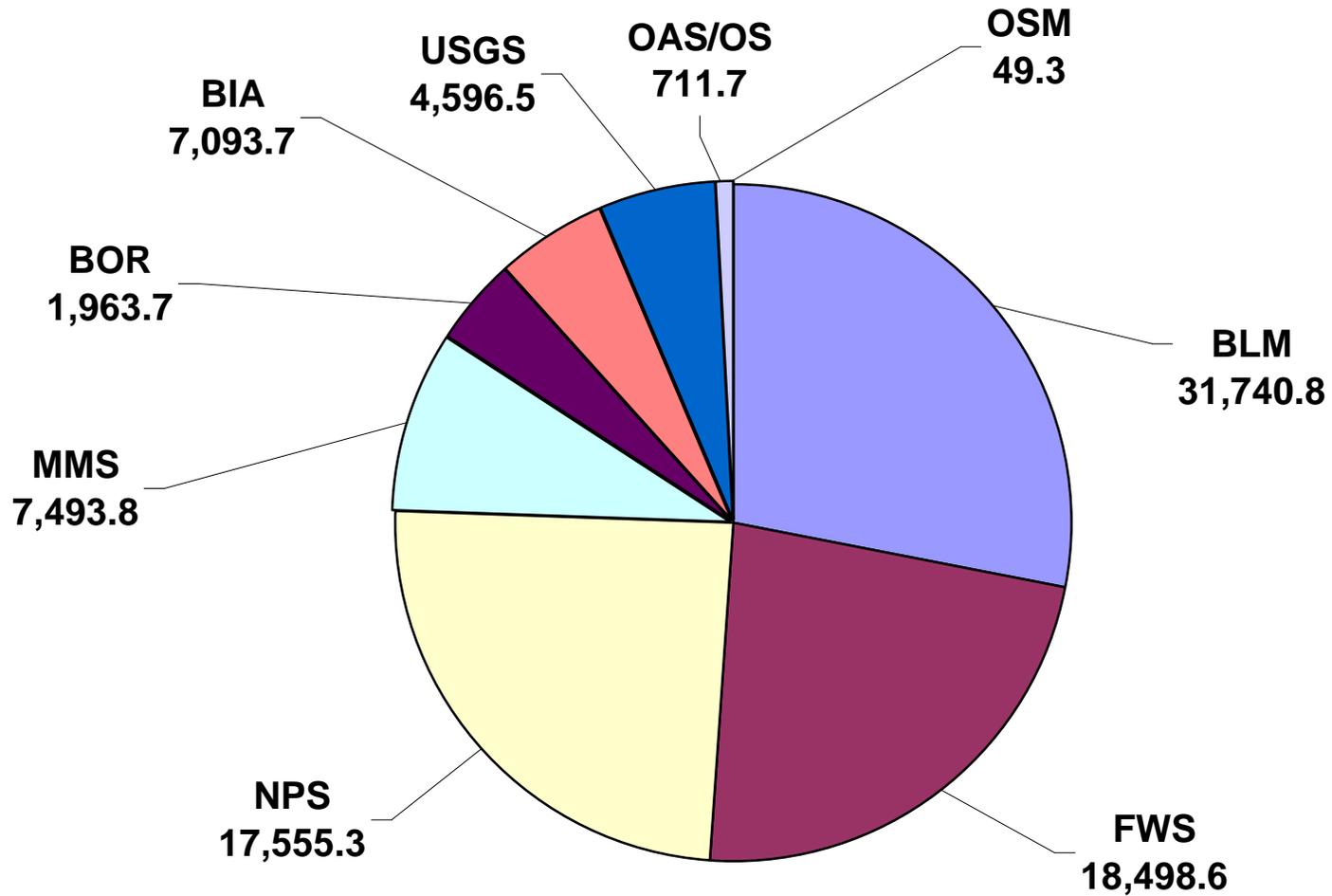
FATALITY RATE HISTORY

Year	Rental		Fleet		Contract		Total (Annual)			Total (Historical)		
	Fatalities	Rate	Fatalities	Rate	Fatalities	Rate	Fatalities	Fatalities*	Rate	Fatalities	Fatalities*	Rate
75	0	0.00	7	66.04	0	n/a*	7	3	66.04	7	3	66.04
76	0	0.00	0	0.00	0	0.00	0	13	0.00	7	16	9.87
77	0	0.00	0	0.00	5	7.52	5	0	4.94	12	16	6.97
78	0	0.00	1	2.53	0	0.00	1	1	1.00	13	17	4.79
79	0	0.00	2	8.31	0	0.00	2	0	1.79	15	17	3.91
80	0	0.00	0	0.00	0	0.00	0	5	0.00	15	22	2.98
81	0	0.00	0	0.00	3	3.82	3	2	2.56	18	24	2.89
82	0	0.00	0	0.00	0	0.00	0	0	0.00	18	24	2.51
83	0	0.00	0	0.00	0	0.00	0	0	0.00	18	24	2.22
84	1	4.60	0	0.00	0	0.00	1	2	0.99	19	26	2.08
85	0	0.00	0	0.00	0	0.00	0	1	0.00	19	27	1.86
86	4	11.01	0	0.00	6	13.66	10	4	9.46	29	31	2.58
87	0	0.00	0	0.00	1	2.60	1	1	1.04	30	32	2.46
88	0	0.00	0	0.00	0	0.00	0	0	0.00	30	32	2.26
89	0	0.00	0	0.00	0	0.00	0	0	0.00	30	32	2.09
90	0	0.00	0	0.00	0	0.00	0	1	0.00	30	33	1.95
91	2	7.31	0	0.00	0	0.00	2	1	2.20	32	34	1.97
92	0	0.00	0	0.00	0	0.00	0	0	0.00	32	34	1.86
93	1	4.02	0	0.00	0	0.00	1	4	1.23	33	38	1.83
94	0	0.00	0	0.00	0	0.00	0	0	0.00	33	38	1.75
95	0	0.00	0	0.00	0	0.00	0	1	0.00	33	39	1.68
96	0	0.00	0	0.00	0	0.00	0	0	0.00	33	39	1.62
97	0	0.00	1	4.18	4	14.65	5	2	6.69	38	41	1.80
98	8	37.36	0	0.00	0	0.00	8	1	11.36	46	42	2.11
99	2	8.45	0	0.00	0	0.00	2	0	2.68	48	42	2.12
00	3	9.94	0	0.00	1	2.57	4	2	4.39	52	44	2.21
01	0	0.00	0	0.00	0	0.00	0	0	0.00	52	44	2.13
02	0	0.00	0	0.00	0	0.00	0	0	0.00	52	44	2.06
Total	21	3.32	11	1.61	20	1.65	52	44	2.06			

* Non-DOI fatalities associated with DOI aircraft accidents.

** Contract flight hours not available in 1975.

BUREAU FLIGHT HOURS FY 02



Total flight hours - 89,703.4

BUREAU STATISTICS

5 YEAR HISTORY

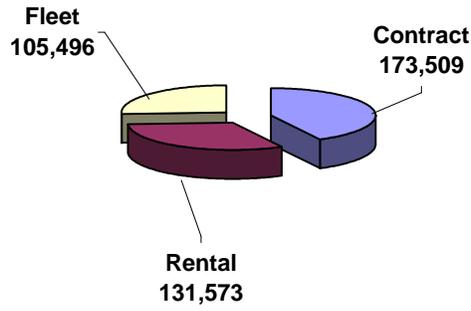
Bureau	Statistic	FY 98	FY 99	FY 00	FY01	FY02	TOTAL
BLM	Hours	17,959.0	20,780.8	31,422.1	29,178.5	31,740.8	131,081.2
	Accidents	3(1)	2(1)	3	2	1	11(2)
	Rate	16.7	9.6	9.5	6.8	3.2	8.4
FWS	Hours	18,315.9	17,209.5	19,117.9	17,783.8	18,498.6	90,925.7
	Accidents	2	1	1	1	4	9
	Rate	10.9	5.8	5.2	5.6	21.6	9.9
NPS	Hours	16,742.3	18,177.5	19,283.1	17,999.1	17,555.3	89,757.3
	Accidents	0	0	1	1	1	3
	Rate	0.0	0.0	5.2	5.6	5.7	3.3
MMS	Hours	6,399.1	6,537.2	7,574.9	6,988.6	7,493.8	34,993.6
	Accidents	0	0	0	0	0	0
	Rate	0.0	0.0	0.0	0.0	0.0	0.0
BOR	Hours	2,626.0	2,978.6	2,510.8	2,236.7	1,963.7	12,315.8
	Accidents	1	0	0	0	0	1
	Rate	38.1	0.0	0.0	0.0	0.0	8.1
BIA	Hours	3,145.8	4,083.5	5,714.3	4,488.9	7,093.7	24,526.2
	Accidents	1	0	0	0	0	1
	Rate	31.8	0.0	0.0	0.0	0.0	4.1
USGS	Hours	4,629.3	4,004.2	4,769.2	5,507.1	4,596.5	23,506.3
	Accidents	0	0	0	0	2	2
	Rate	0.0	0.0	0.0	0.0	43.5	8.5
OAS/OS	Hours	470.6	619.5	662.0	730.7	711.7	3,194.5
	Accidents	0	1	0	0	0	1
	Rate	0.0	161.4	0.0	0.0	0.0	31.3
OSM	Hours	89.9	33.9	42.6	62.6	49.3	278.3
	Accidents	0	0	0	0	0	0
	Rate	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	Hours	70,377.9	74,424.7	91,096.9	84,976.0	89,703.4	410,578.9
	Accidents	7(1)	4(1)	5	4	8	28(2)
	Rate	9.9	5.3	5.5	4.7	8.6	6.8

() Indicates non-accountable accidents or non-chargeable accidents.

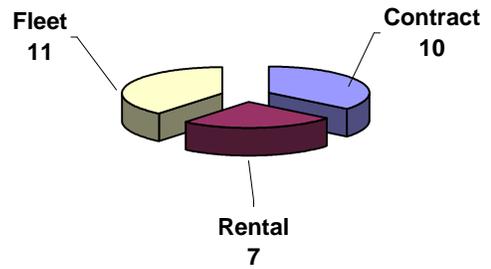
SOURCE COMPARISONS

FY 98 - FY 02

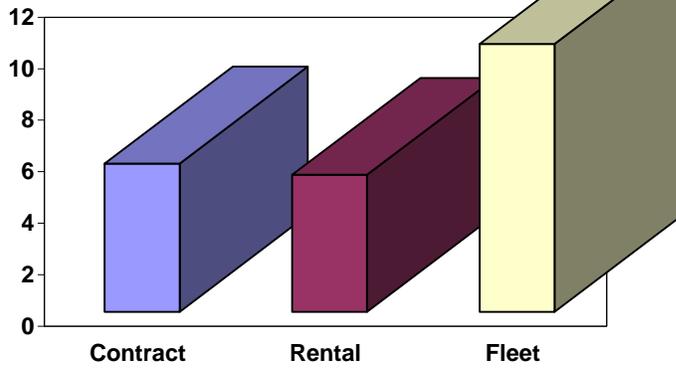
Hours



Accidents



Rates

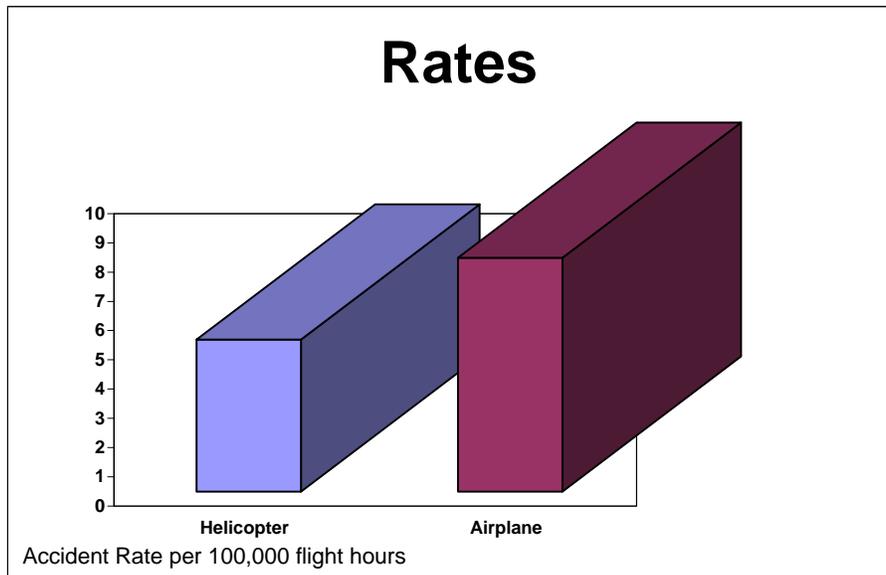
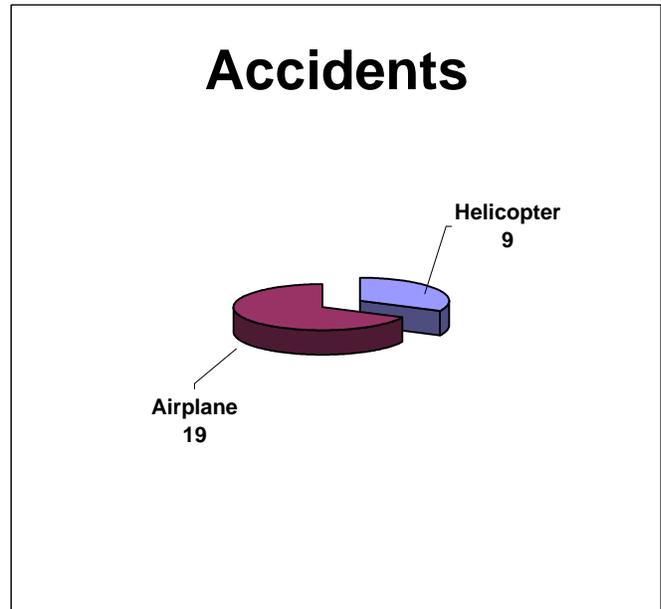
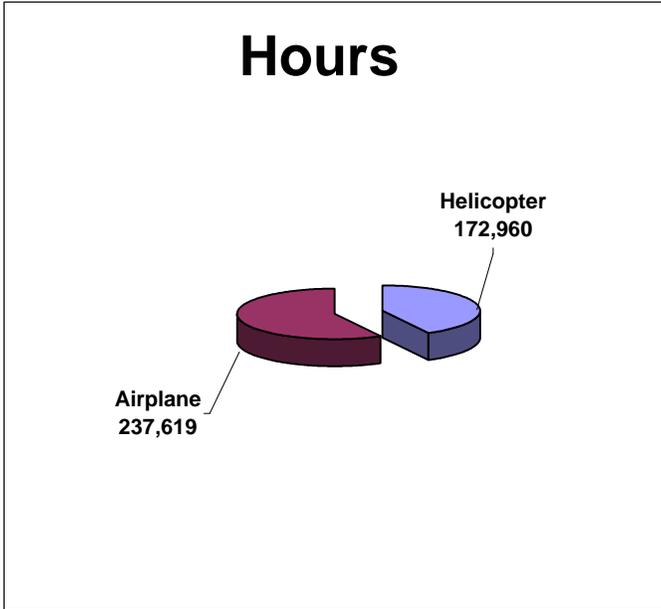


Accident Rate per 100,000 flight hours

Contract = 5.76
Rental = 5.32
Fleet = 10.42

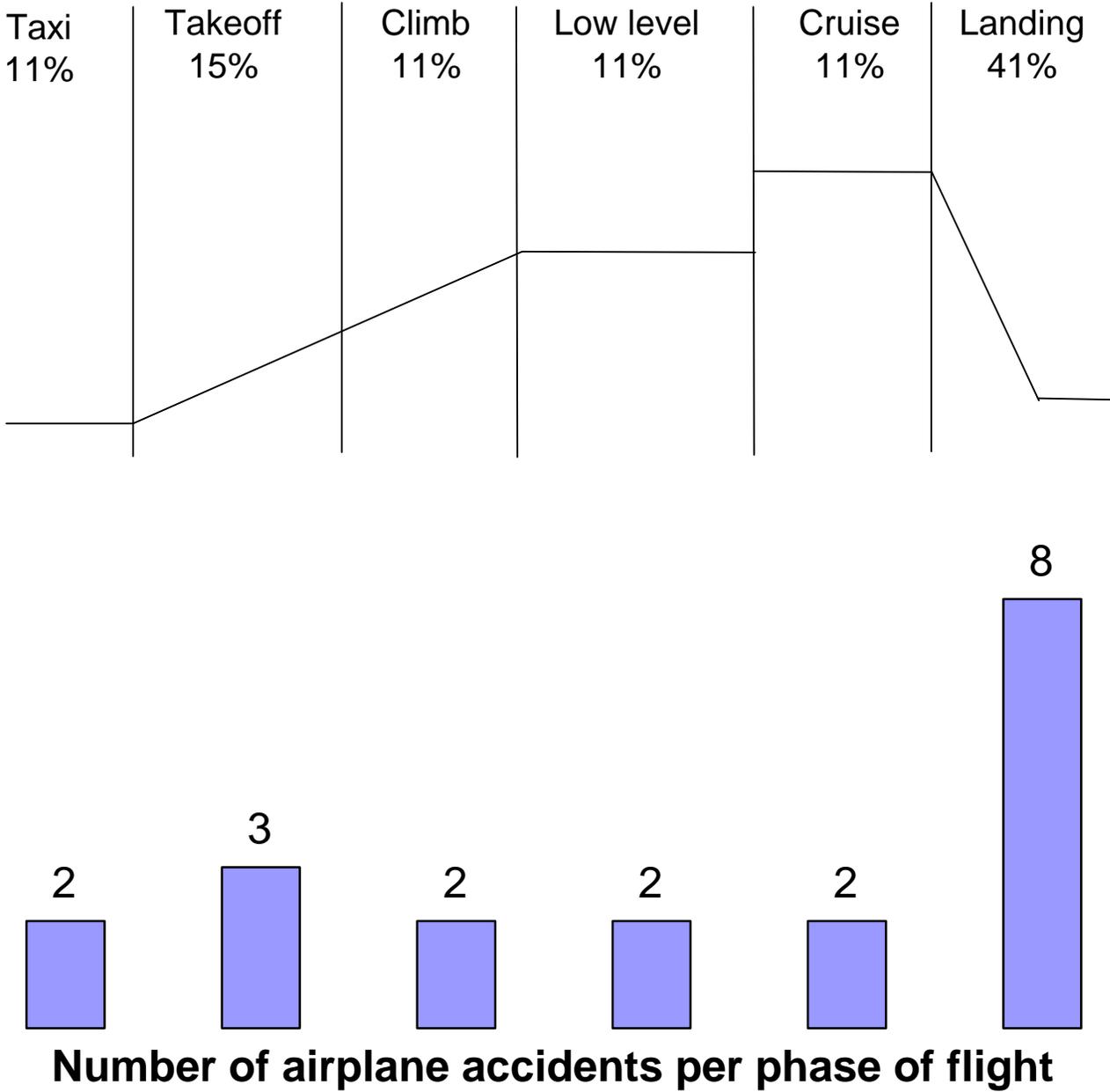
AIRCRAFT COMPARISONS

FY 98 - FY 02

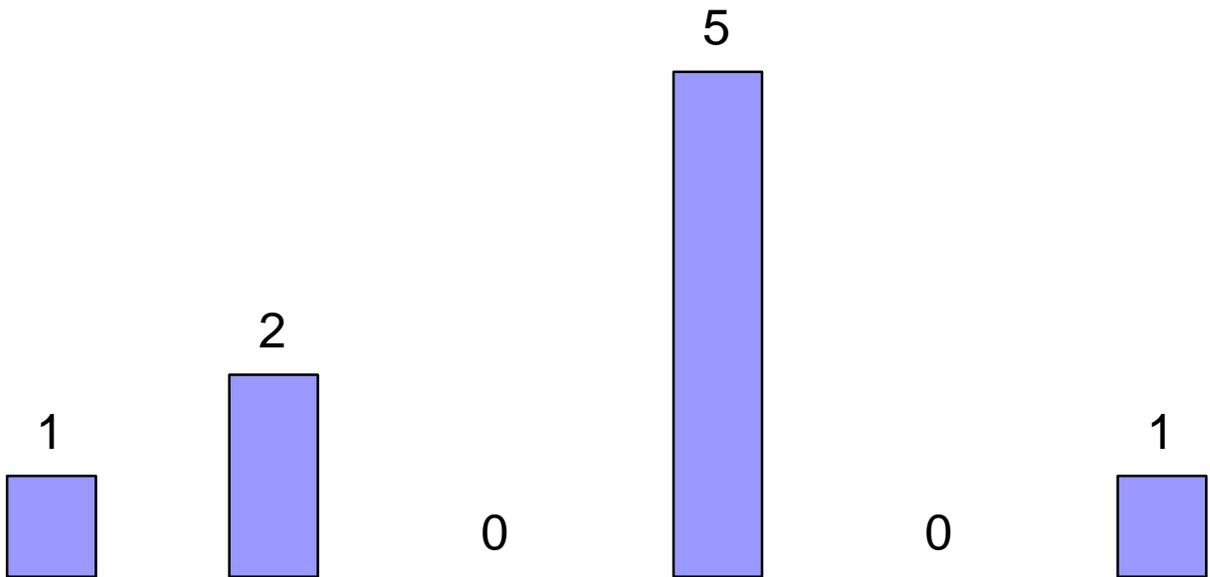
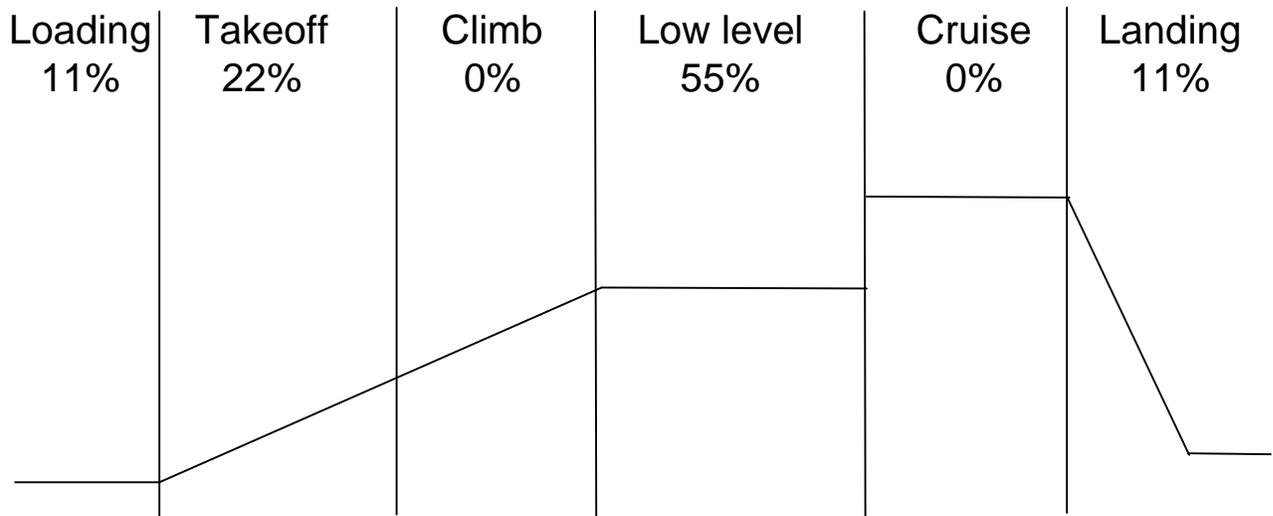


Airplane = 7.99
Helicopter = 5.20

Airplane Phase of Flight Comparisons FY 98 - FY 02



Helicopter Phase of Flight Comparisons FY 98 - FY 02

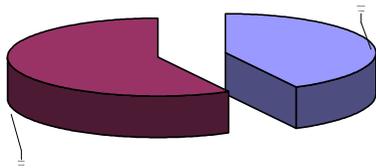


Number of helicopter accidents per phase of flight

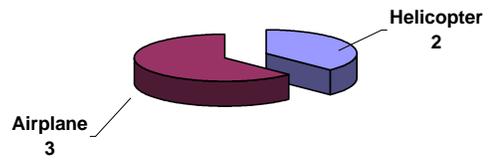
FATAL ACCIDENT COMPARISONS

FY 98 - FY 02

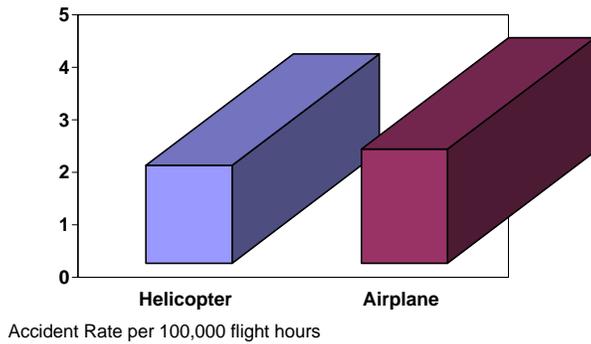
Hours



Accidents



Rates



Airplane = 1.3
Helicopter = 1.2

Section IV

SAFECOM

Department of the Interior's Hazard Identification and Reporting System

The purpose of the Safecom system and the submission form is to allow users to report anything that has the potential to adversely affect aviation operations. Although maintenance problems, airspace conflicts, and flight following issues are some of the more commonly reported topics, the Safecom system is also available to report human factors issues such as a loss of situational awareness, exceeding crew rest, or breakdowns in crew resource management (CRM).

Safecom reports are not used in any administrative or punitive action against either the subject of a report or a submitter. However, if situations being reported are subsequently verified by an independent reporting source, corrective measures may be taken.

A commonly held perception is that the Safecom system is to be used only by government employees. However, we encourage the use of the system by anyone engaged in DOI aviation activities that either observes or identifies a hazard.

Safecom reports may be submitted in any manner that suits the sender, via the web at www.oas.gov, by phone (1-888-4MISHAP), by fax (1-208-433-5085), or by mail.

Keep in mind that the most important aspect of a Safecom submission is "what happened" (or what is happening) as opposed to "who is reporting" the event or "who was involved" in the event. To that end, our intentional focus on the "what" is consistent with the identification and correction of the potential hazard at the lowest possible level. That is, the submitter provides a narrative description of the "what" followed by an opportunity to provide comments describing corrective action(s) taken following the reported event. Anonymously filed reports are also acceptable and are treated with the same sense of urgency as Safecom reports that identify the submitter.

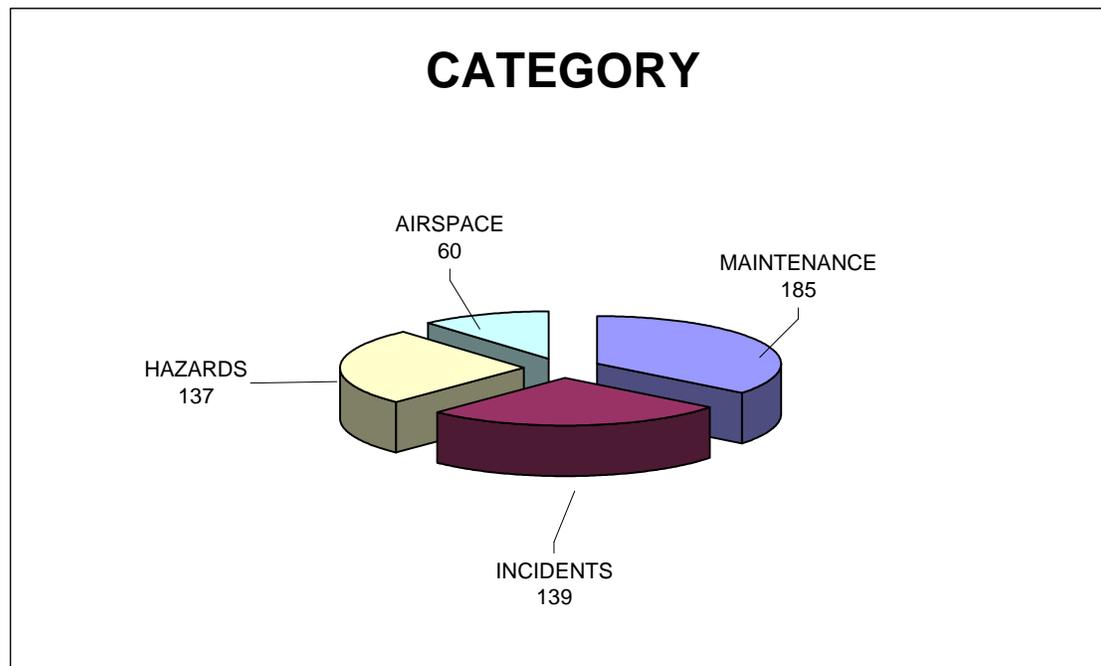
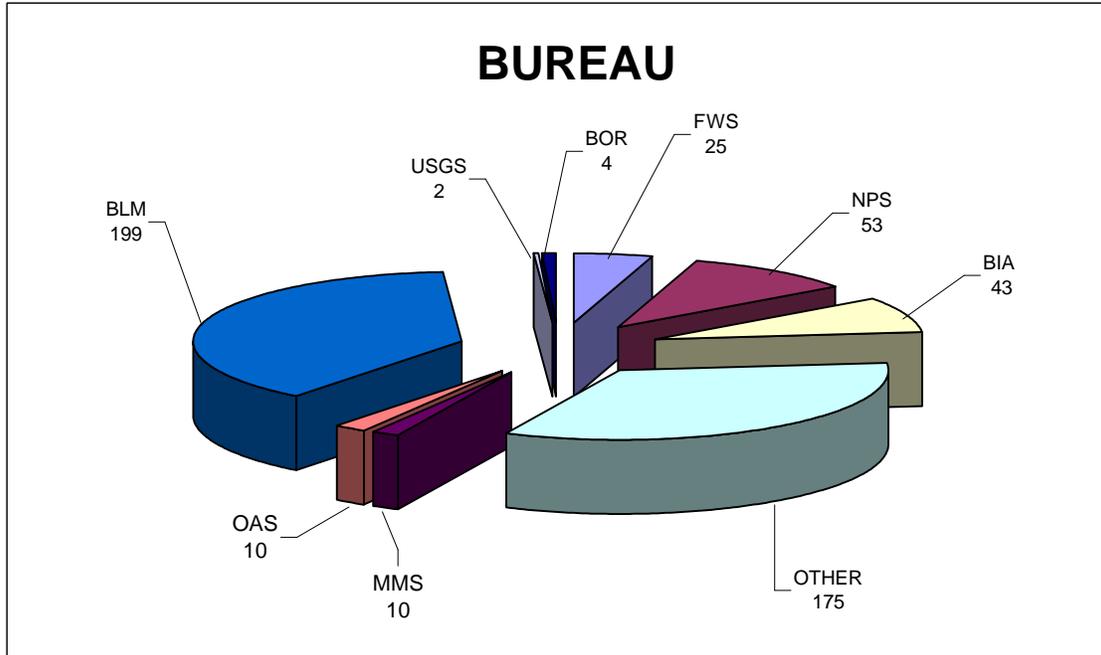
It is important to understand that **WE ARE DEPENDING ON YOU** to let us know what's going on in the field.

The OAS Aviation Safety Office received a total of 521 SAFECOM reports in FY 02. The subtotals of the FY 02 reports were: 139 aircraft incidents, 60 airspace conflicts, 137 aviation hazards, and 185 aircraft maintenance deficiencies.

Graph 11	Bureau Summary
Graph 12	Category Summary
Graph 13	Incident Summary
Graph 14	Hazard Summary
Graph 15	Maintenance Summary
Graph 16	Airspace Summary
Graph 17	Eight-Year Trend Analysis

SAFECOM SUMMARY

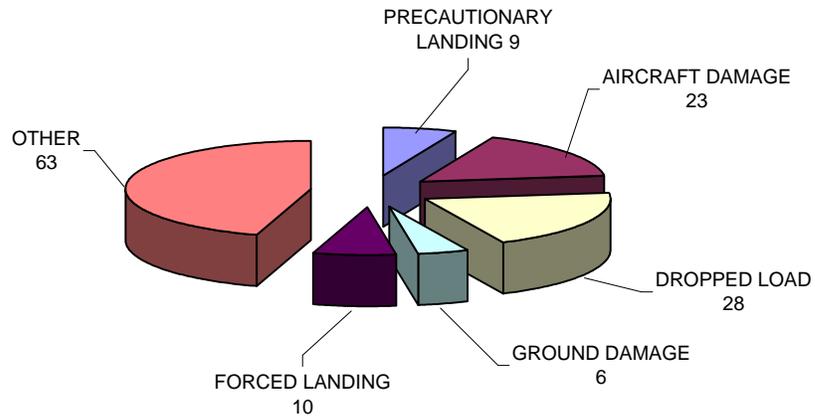
FY 02



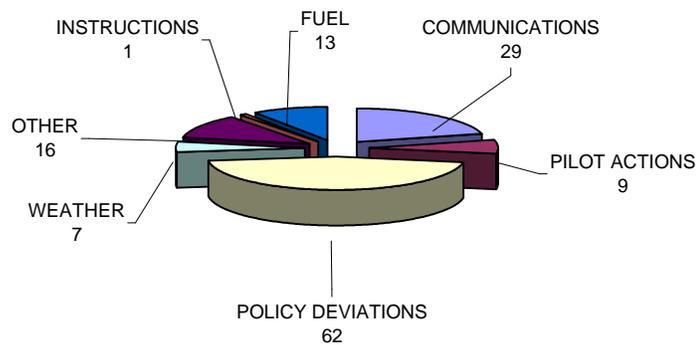
SAFECOM SUMMARY

FY 02

INCIDENT



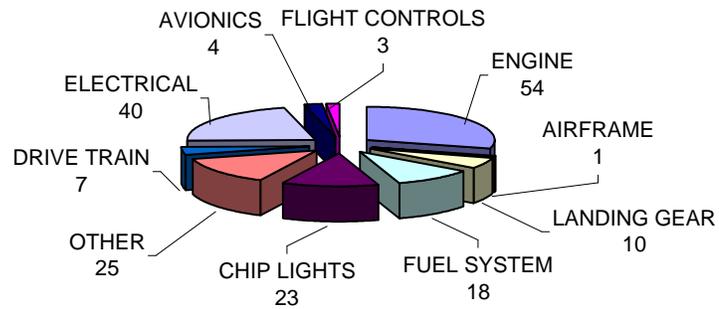
HAZARD



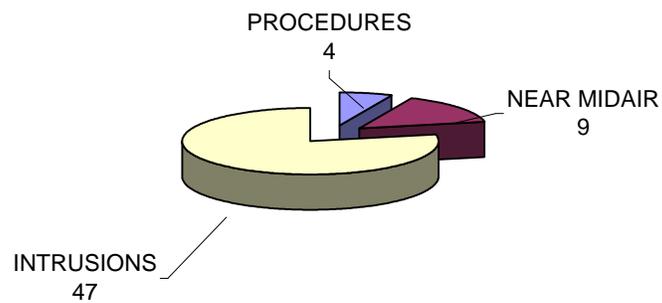
SAFECOM SUMMARY

FY 02

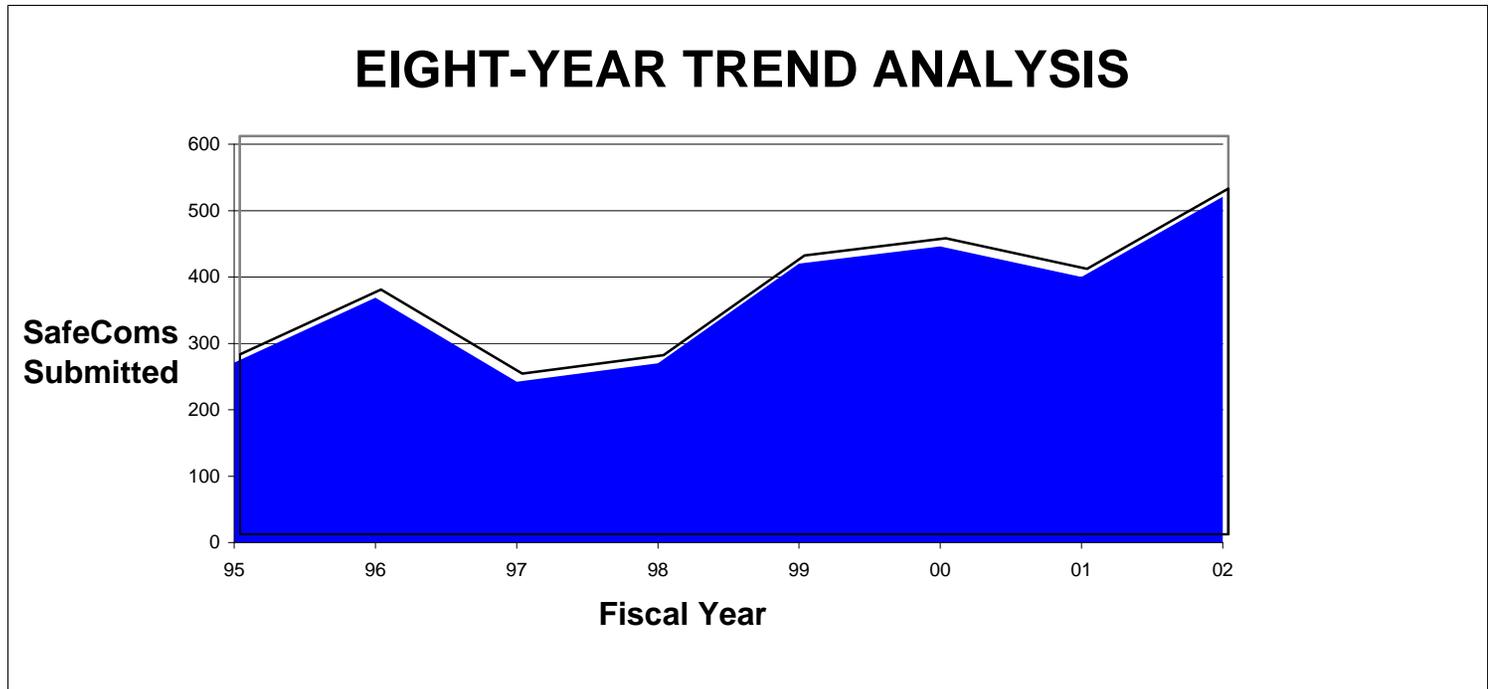
MAINTENANCE



AIRSPACE



95	271
96	369
97	242
98	270
99	420
00	446
01	400
02	521



GLOSSARY

Aircraft accident. An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

Aircraft incident. An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations.

Airspace conflict. A near midair collision, intrusion, or violation of airspace rules.

Aviation hazard. Any condition, act, or set of circumstances that exposes an individual to unnecessary risk or harm during aviation operations.

Fatal injury. Any injury which results in death within 30 days of the accident.

Forced landing. A landing necessitated by failure of engines, systems, or components which makes continued flight impossible, and which may or may not result in damage.

Incident with potential. An incident that narrowly misses being an accident and in which the circumstances indicate significant potential for substantial damage or serious injury. Final classification will be determined by the OAS Aviation Safety Manager.

Maintenance deficiency. An equipment defect or failure which affects or could affect the safety of operations, or that causes an interruption to the services being performed.

Non-chargeable accidents. Accidents in which DOI was not exercising operational control over the aircraft at the time of the accident but in which DOI employees or DOI-procured aircraft were involved.

Operator. Any person who causes or authorizes the operation of an aircraft, such as the owner, leasee, or bailee of an aircraft.

Precautionary landing. A landing necessitated by apparent impending failure of engines, systems, or components which makes continued flight inadvisable.

Serious injury. Any injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

Glossary

Substantial damage. Damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage" for the purpose of 49 CFR Part 830.