A Research Report for the Jackson Hole Conservation Alliance

# SAFETY RISKS AND ENVIRONMENTAL PERILS OF SCENIC HELICOPTER TOURS IN TETON COUNTY, WYOMING

Jackson, Wyoming

May 2001

# OVERVIEW

## WHAT WE FOUND

- In general, helicopters are a relatively safe form of travel. Yet casualties from scenic helicopter tour operations have soared. Last year the number of people killed or injured in helicopter scenic tour crashes was 460% higher than the toll five years earlier.

- Four of the five deadliest U.S. civilian helicopter crashes in the last decade have resulted from scenic helicopter tours in mountainous terrain. These four crashes occurred at much lower elevations than a helicopter will encounter along the route planned for Wyoming. All four involved the same make and series of helicopter that is planned for scenic tours in Wyoming.

- The FAA has recognized that environmental impact statements may be required in the development of new scenic air tour routes. And there is no question that heli-tours would have an impact in Teton County, Wyoming. Government studies show that animals sometimes stampede or abandon their normal ranges when subjected to helicopter overflights. An FAA study found that one of the most widespread species of waterfowl in Teton County -- the Canada goose -- did not "tolerate" the helicopter noise "at any level." Another study found that nesting bald eagles panic when helicopters pop over a cliff.

- Helicopters also cause a greater "flight-fright response" in wildlife than fixed-wing aircraft, the studies show. The lower the helicopter overflight, the more extreme is likely to be the response. This is particularly noticeable in bighorn sheep and grizzly bear, two species whose habitat is under the flight path of proposed Teton County helicopter scenic tours.

## WHAT SHOULD BE DONE

- Ban commercial scenic helicopter tours in Teton County for the compelling environmental, economic and safety reasons set forth in this report. The best chance to begin this process is to support Senator Craig Thomas's bill aimed at banning scenic air tours over Grand Teton and Yellowstone National Parks.
- While Congress is deliberating the legislation covering the two parks, the FAA should impose a temporary ban on all scenic helicopter tour flights in Teton County and should conduct urgent rulemaking with the object of adopting a Special Federal Aviation Regulation (SFAR) to achieve the following:

    1. Reduce the risk of accidents by requiring a suitable minimum altitude above ground level ("AGL") for all commercial scenic helicopter tours over Teton County and other Wyoming counties seeking this protection. The FAA should be commended for achieving a major reduction in scenic helicopter accidents in Hawaii by ordering a 1,500-foot minimum altitude AGL for scenic air tours in that state. Teton Couny deserves no less protection, and its extraordinarily challenging terrain may warrant even an even greater margin of safety.
    2. Minimize the effects on wildlife and human visitors by requiring a suitable minimum altitude AGL for scenic helicopter tours over the National Elk Refuge and the four national wilderness areas in Teton County, as well as other refuges and wildernesses in Wyoming seeking such protection. The FAA has issued an advisory circular to pilots suggesting a 2,000-foot minimum altitude AGL over wildlife refuges and national wilderness areas. But the U.S. Fish and Wildlife Service has reported that the advisory circular is often ignored.
    3. Impose realistic safety precautions for high-altitude scenic tours. These should include requiring pilots experienced in mountain flying, helicopters built to fly in "hot and high" conditions, ground proximity warning systems, and up-to-date technology for emergency communications. (For details on proposed safety upgrades, see page 33.)

## ABOUT THIS REPORT

This report was researched and written for the Jackson Hole Conservation Alliance by two Alliance members, Joe Albright and Marcia Kunstel. For information about their background, see "About the Authors" on page 56.

In this internet age citizens can pan for information in a huge assortment of data streams. It is amazing how many nuggets are waiting to be found and carefully weighed.

For Part One of this report, the most important source has been the voluminous U.S. National Transportation Safety Board database detailing more than 46,700 aviation accidents dating back until 1983. In January 2001, the NTSB made all these accident reports available on its website in a form that can be downloaded to a personal computer. Once downloaded, the reports can be sorted and analyzed using standard database and spreadsheet programs such as ACCESS and EXCEL. A second important information source for Part I has been Rotor Roster 2001, an authoritative private database of worldwide helicopter registrations that is sold for $25 in the form of a CD-ROM disk.

For Part Two, the most important sources have been a series of fairly obscure U.S. government reports touching on the impact of helicopter noise on wildlife and humans. Most were sponsored by the Federal Aviation Administration, the National Park Service, the Fish and Wildlife Service and the Air Force during the Reagan and Clinton administrations. The best online collection of these reports is to be found at http://www.nonoise.org.

For further background, see "Sourcing" on page 54.

This report is a work in progress. Please send any comments, suggestions and corrections to: Heli-Tour Research Report, c/o Jackson Hole Conservation Alliance, PO Box 2728, Jackson, Wyoming 83001.

## PROSPECTIVE HELI-TOUR OPERATOR RESPONDS

On February 21, 2001 the portions of this report dealing with the safety of helicopter tours were sent in draft form to the prospective Teton County helicopter tour operator, Vortex Aviation Services LLC of El Cajon, California ("Vortex Aviation"). Vortex Aviation was invited to make any comments or suggestions and to offer any factual corrections.

Mr. Gary Kauffman, managing member of Vortex Aviation, responded in a two-page letter postmarked March 10, 2001 that stressed his company's "priority interest" in protecting the safety of its passengers and his company's support for the environmental goals of the U.S. Park Service and U.S. Forest Service. Here is an excerpt:

> Safety of flight which ensures the safety of our passengers is the priority interest of Vortex Aviation Services. In this regard we meet, and exceed, FAA regulations. Our pilots and mechanics are all subject to drug and alcohol testing, our pilots are regularly tested by the FAA, and a flight following procedure is in place for every charter and scenic air tour flight. . . .
>
> Vortex is a member of the Helicopter Tour Operator Committee of the HAI (Helicopter Association International) and this membership keeps us abreast with the latest safety issues and concerns as air tour operators. We have not seen anything coming from the HAI or the FAA that reflects your "findings."

The Vortex Aviation letter did not offer any factual corrections to the draft report. (Note: The full text of the Vortex Aviation lettter appears in Appendix 12 on page 52 of this report.)

# Table of Contents

**TABLES** **PAGE**

# Part One

# THE RISKS OF INJURY AND DEATH IN HIGH-ALTITUDE MSL SCENIC HELICOPTER TOURS

## "SAFETY FIRST" IS ONE MOTTO THAT UNITES EVERYONE

All sides in the scenic helicopter tour controversy agree that if scenic helicopter tours are going to come to Wyoming, they must be as safe as humanly possible. It is vital, therefore, to begin examining the safety issues arising from scenic helicopter tours over remote high-mountain wilderness terrain like that in Teton County, Wyoming. In this section dealing with the safety aspects of scenic helicopter tours, these are some salient points:

- In general, helicopters are a relatively safe form of travel.
- Yet casualties in scenic helicopter tour accidents have soared. Last year the toll of people killed or injured in crashes in the scenic helicopter tour industry was 460% higher than the number of killed or injured five years earlier.
- Four of the five most deadly U.S. civilian helicopter crashes in the last decade have resulted from scenic helicopter tours.
- Only about 2.5% of all U.S.-registered helicopters are devoted to scenic helicopter tour flights. Yet over the last three years, a disproportionately high 13% of all deaths in civilian helicopter accidents have resulted from heli-tour crashes.
- The Wyoming backcountry route considered for scenic tour flights would be extraordinarily challenging for helicopters carrying full loads of summer tourists. The density altitude along the proposed route could often reach 12,000-14,000 feet. Pilots would have to contend with high mountain passes with elevations of 9,600 feet and unpredictable high winds and fog.
- The helicopter planned for Jackson Hole scenic tours could prove a risky choice:
    - ✓ It crashed-landed in October 2000 in California, suffering "substantial" damage. The pilot reported seeing "something fly off the helicopter," and he couldn't control his descent. The cause of the accident remains under NTSB investigation.
    - ✓ The same make and model of helicopter was involved in the four most deadly scenic helicopter tour accidents in the last decade.
    - ✓ All four of these crashes occurred at much lower density altitudes than a scenic helicopter tour pilot would encounter over the backcountry of Teton County, Wyoming.

# SCENIC TOURS IN HELICOPTERS HAVE BECOME MORE DANGEROUS

Helicopters are vital to the national economy. They are also a relatively safe mode of air travel, on a par with small fixed-wing planes. The accident rates of civilian helicopters and general aviation planes were found to be almost identical in a helicopter safety study in the mid-1990s by NASA's Ames Research Center. A compilation by the Helicopter Association International of NTSB statistics (see http://www.rotor.com) shows that the civilian helicopters experienced a slightly lower rate of fatal accidents per 100,000 hours than general aviation airplanes in 1995-1997.

Yet scenic helicopter touring -- a specialized form of commercial helicopter flight for the purpose of sightseeing -- has become far more dangerous than the total of all forms of civilian helicopter travel such as law enforcement, oil service, medevac, forestry, news coverage, movie-making, helicopter skiing, air taxis and other important helicopter uses.

The accident record is unsettling, to say the least:

- Over the last decade, 347 people have been in 71 scenic tour helicopter accidents. These accidents killed 51 people and injured 131. (See Appendices 1 and 2 on pages 34-42 for details.)
- Four of the five most deadly civilian helicopter accidents during the last decade happened during scenic helicopter tours. (See Table 1 on page 8 for details.)
- On July 14, 1994, two scenic tour helicopters crashed on the same day into the ocean off Hawaii and three people drowned. These were the 28th and 29th scenic helicopter tour accidents in Hawaii in a six-year period. (See Appendix 1 on page 34 for details.)
- The FAA responded to this pattern of Hawaii accidents with a nationwide regulatory crackdown on air tour operators, including tough inspections at airports in Hawaii and Nevada used by air tour operators. For air tours in Hawaii, the FAA ordered that all air tour operators must observe a 1,500-foot minimum altitude AGL. The number of heli-tour accidents declined significantly from 1994 to 1996. (See Appendices 1 and 2 on pages 34-42 for details.)
- In 1995 the NTSB notified the FAA and the public that it "has long been concerned about the occurrence of air tour accidents" after a special investigation into 139 air tour accidents throughout the United States over a seven-year period, involving tours in helicopters and other aircraft. (See Appendix 1 on page 34 for the NTSB report's descriptions of each U.S. heli-tour accident.)
- Yet despite stepped-up FAA and NTSB scrutiny, the numbers of scenic helicopter tour accidents and fatalities have once again escalated. Scenic heli-tour accidents were 400% higher in 2000 than they were in 1996. Deaths and injuries from scenic heli-tours were 460% higher in 2000 than in 1996. (See Table 2 on page 8 for the uptrend in heli-tour accidents since the 1995 NTSB special investigation. See Appendix 2 on page 39 for descriptions of all known U.S. heli-tour industry accidents which have occurred since the 1995 NTSB special investigation.)
- Over the last three years, 13% of all deaths in helicopter accidents have resulted from scenic helicopter tour operations. (See Table 3 on page 10 for an analysis and breakdown.)
- This percentage is remarkably high in light of the fact that only about 2.5% of all U.S.-registered helicopters are devoted to scenic helicopter tour operations. (See Appendix 11 on page 51 for the methodology leading to this estimate.)

The good news is that the FAA's Special Federal Aviation Regulation No. 71 for Hawaii scenic air tours has worked by dramatically reducing the number of heli-tour accidents in that state.

- In the six years prior to the adoption of SFAR No. 71, heli-tour accidents happened in Hawaii at the rate of one every 72 days. (See Appendix 1 on page 34 for NTSB descriptions of these accidents.)
- In the six years and a half years after the adoption of SFAR No. 71, heli-tour accidents in Hawaii happened at the rate of one every 330 days. (See Appendices 1 and 2 on pages 34-42 for descriptions of these accidents from NTSB accident reports.)

**TABLE 1**

**THE FIVE DEADLIEST U.S. CIVILIAN HELICOPTER ACCIDENTS (1991-2000)**

| Date | Location | Deaths | NTSB Finding on Cause | Scenic Tour? |
|---|---|---|---|---|
| 7/24/91 | Mercury, Nevada | 6 | Not in NTSB database | No (*) |
| 9/16/92 | Hana, Hawaii | 7 | Pilot Error/Thunderstorm | Yes |
| 6/25/98 | Mount Waialeale, Hawaii | 6 | Still Under Investigation | Yes |
| 6/9/99 | Herbert Glacier, Alaska | 7 | Pilot Error/Whiteout | Yes |
| 7/21/00 | Kahului, Hawaii | 7 | Still Under investigation | Yes |

Source: NTSB reports compiled from http://www.ntsb.gov/NTSB/query.asp.

(*) Crash of a security helicopter at the U.S. Department of Energy's Nevada Test Site.

**TABLE 2**

**ESCALATING TOLL OF U.S. HELI-TOUR CRASHES (1996-2000)**

| | Accidents | Deaths | Injuries | Deaths and Injuries |
|---|---|---|---|---|
| 1996 | 2 | 0 | 5 | 5 |
| 1997 | 1 | 0 | 4 | 4 |
| 1998 | 6 | 8 | 4 | 12 |
| 1999 | 10 | 10 | 21 | 31 |
| 2000 | 10 | 8 | 20 | 28 |
| **% up 1996-2000** | **400%** | **(*)** | **300%** | **460%** |

NTSB accident reports compiled from http://www.ntsb.gov/NTSB/query.asp**.**

(*) Cannot divide by zero so a percentage cannot be calculated

## WHY HAVE SCENIC HELI-TOURS RESULTED IN SUCH A BIG SHARE OF THE DEATHS IN ALL U.S. HELICOPTER CRASHES?

The FAA, DOT and the NTSB share a duty to find answers to this question because all three bear the responsibility to protect the safety of the flying public in Wyoming and elsewhere.

In 1995, the NTSB expressed its frustration that the government was so much in the dark about the causes and trends of air tour accidents. "The lack of a national data base for air tour operations precludes effective evaluation of the accident rate of air tour operators on the traditional basis of flight hours, cycles and passengers carried," the NTSB wrote after a special investigation of air tour accidents. The safety board issued a priority recommendation that the DOT should "establish and maintain a data base of all air tour operators that would provide data for use in determining the scope of air tour operations and accident rates that can be used to assess the safety of the air tour industry."

Six years later, despite repeated prodding from the NTSB, the DOT has not succeeded in creating a database on scenic tour operations that makes it possible for safety experts to measure the rates and trends of accidents and fatalities per 100,000 hours flown, or per takeoff, or per passenger. (For more on DOT's response, see Appendix 11 on page 51.)

In view of the 460% increase in heli-tour deaths and injuries since five years ago, it is time for the NTSB to reopen its 1995 special investigation of air tour safety. The industry group Helicopter Association International has shown in its 1998 study "Survey of Helicopter Tour Operators" (see http://www.rotor.com) that it is possible through a detailed questionnaire to collect the kind of data for the accident studies the NTSB has sought from other government agencies. Table 8 on page 10 shows the kind of analysis that is possible using data already available to the public. Here are some factors to be considered if there is another NTSB inquiry on how to make heli-tour operations safer.

- **Increase in Heli-Tour Flights?** The number of heli-tours flown throughout the United States has risen considerably over the last 15 years. But heli-tour traffic can hardly have risen steeply enough to account for the 460% increase in heli-tour deaths and injuries since five years ago. Only about 2.5 percent of all helicopters are devoted to commercial scenic helicopter tour operations.

- **What kind of helicopters?** The 29 heli-tour crashes over the last five years have involved helicopters made by seven manufacturers. Clearly, the high rate of heli-tour accidents and deaths is not just linked to a problem with any one type of helicopter.

- **Airspace Conflicts?** Four major scenic helicopter tour accidents in the last 15 years were mid-air collisions in crowded low-altitude AGL airspace. Twenty-five died over Grand Canyon in 1986 when a heli-tour helicopter collided with a fixed-wing air tour plane; four died when two scenic helicopters crashed over the Canadian side of Niagara Falls in 1992; 12 were injured when two scenic helicopters collided over the Grand Canyon in 1993, and two died when a scenic helicopter crashed into a small airplane near Juneau, Alaska, in 1998. These four crashes were part of a larger pattern. The National Park Service has warned that low-level airspace over public lands "can sometimes be very busy." In a 1994 report to Congress, the Park Service reported that in 1992, U.S. Department of Interior aircraft had 28 near-misses with civilian aircraft and another 11 with military aircraft.

- **Divided attention?** At critical moments, part of a scenic helicopter tour pilot's attention may be devoted to providing a running narration to passengers about what they are seeing on the ground. This is an extra duty that does not burden other helicopter pilots. While no heli-tour accidents are known to have been caused by this, the NTSB database records numerous helicopter accidents in which the probable cause was pilot inattention at critical moments.

- **Incentives to Fly Too Close to Danger?** The job of a scenic helicopter pilot is to provide passengers with thrills day after day by repeatedly flying close to mountains, volcanoes and other scenic landmarks. This is in contrast to the job of almost all other civilian helicopter pilots, whose job is to fly passengers and cargo directly from Point A to Point B while trying to stay as far as possible from any obstacle that might pose a crash hazard. A review of NTSB accident reports shows instances

when scenic tour pilots crashed by trying to afford tourists an up-close view of an obstacle that other helicopter pilots might detour around. Some examples:

- ✓ **March 25, 1994:** A helicopter hovering 40 feet over a volcano vent in Hawaii National Park crashed after it was engulfed in a steam cloud from the volcano. Rescue efforts were delayed by sulfuric fumes in the steam cloud. Two people were injured.

- ✓ **June 9, 1999:** A scenic tour helicopter, piloted by a novice pilot with no training in instrument flying, crashed in fog and whiteout conditions into the Herbert Glacier near Juneau, Alaska. The NTSB said one contributing factor was "pressure by the company to continue flights in marginal weather." Seven people were killed.

- ✓ **August 10, 1999:** A pilot maneuvered his helicopter on its side so visitors could shoot closeup video of Mount Rushmore. The helicopter was so close to the mountain that it crashed into rocks and trees. The pilot had already flown seven hours that day. Two people were killed.

**TABLE 3**

**DEATHS IN SCENIC TOUR HELICOPTER ACCIDENTS**
**COMPARED TO DEATHS IN ALL U.S. CIVILIAN HELICOPTER ACCIDENTS**
**(1991-2000)**

| | LAST 3 YEARS 1998-2000 | LAST 5 YEARS 1996-2000 | LAST 10 YEARS 1991-2000 |
|---|---|---|---|
| **SCENIC TOUR HELICOPTERS** | | | |
| Accidents(total) | 26 | 29 | 71 |
| Fatal Accidents (total) | 7 | 7 | 16 |
| Deaths (total) | 26 | 26 | 51 |
| Ratio of Deaths to Accidents | 1.0 | 0.9 | 0.7 |
| % of all Accidents Are Fatal | 27% | 24% | 23% |
| **ALL CIVILIAN HELICOPTERS** | | | |
| Accidents (total) | 613 | 946 | 1,890 |
| Fatal Accidents (total) | 106 | 161 | 337 |
| Deaths (total) | 203 | 295 | 632 |
| Ratio of Deaths to Accidents | 0.3 | 0.3 | 0.3 |
| % of all Accidents are Fatal | 17% | 17% | 18% |
| **SCENIC TOUR HELICOPTER ACCIDENTS AS SHARE OF ALL HELICOPTER ACCIDENTS** | | | |
| % of all Helicopter Accidents | 4% | 3% | 4% |
| % of Fatal Helicopter Accidents | 7% | 4% | 5% |
| % of all Helicopter Deaths | 13% | 9% | 8% |

Source: records found at http://www.ntsb.gov/NTSB/query.asp.

# EXTRA RISKS OF HIGH-ALTITUDE HELI-TOURS OVER WILDERNESS

The high mountain backcountry route envisioned for Teton County scenic tours will be considerably more challenging for pilots in the warm months of the summer than existing scenic heli-tour routes near Grand Canyon, the volcanoes of Hawaii or the glaciers of southeast Alaska.

The prospective tour operator, Vortex Aviation, presented a map to the Jackson Hole Airport Board in July 2000 showing the proposed route of flight for scenic tours in Teton County. The proposed route was as follows: after takeoff from Jackson Hole Airport (elevation 6,424 feet), the helicopter would fly east over the National Elk Refuge and across the Gros Ventre National Wilderness boundary near Kelly, Wyoming (elevation 6,661 feet). The helicopter would then climb and fly a loop in an easterly direction around the east face of Sheep Mountain (elevation 11,239 feet) and descend westward back to the airport.

A scenic heli-tour pilot would confront similar or even higher elevations if he or she were to attempt to fly helicopter scenic tours over the three other national wilderness areas in Teton County -- the Teton Wilderness Area, the Jedediah Smith Wilderness Area and the Winegar Hole Wilderness Area -- or over Grand Teton or Yellowstone National Parks. The Grand Teton reaches 13,766 feet and other peaks in the Teton range exceed 12,000 feet.

The first challenge is the wind. There are no weather stations to record local meteorological conditions along the backcountry portion of the proposed scenic route. But hikers and hunters have experienced extreme wind gusts in the mountains. One "microburst" of wind in the spring of 1999 below Sheep Mountain knocked down a swath of live trees as big as four feet in diameter covering several acres at a relatively low elevation of 7,400 feet. A second challenge is the terrain. Much of the proposed route covers steep, rocky cliffs or mountainsides covered with thick, tall timber. Along much of the route, there are no level clearings where a pilot could make a safe "autorotation" landing.

The third and certainly the toughest challenge is the high elevation. A review of U. S. Geological Survey maps shows that Vortex Aviation's proposed heli-tour route would carry tourists near cliffs and peaks with elevations of 11,239, 11,106, 10,420, 10,084, 10,105 and 10,566 feet. It appears from these maps that the lowest mountain pass through which the Vortex Aviation helicopter would be able to fly around Sheep Mountain is at an elevation of 9,600 feet. All these peaks and mountain passes along the proposed scenic heli-tour route are within the boundaries of the Gros Ventre Wilderness Area, a pristine area set aside for present and future generations under the Wyoming Wilderness Act of 1984, which was sponsored in the House of Representatives by Wyoming congressman Richard Cheney.

Along with other wilderness areas set aside by Congress, the Gros Ventre Wilderness Area enjoys the protection of a FAA-suggested altitude limit of 2,000 feet AGL to limit noise from aircraft overflights. The FAA's Advisory Circular AC-91-36, entitled "Visual Flight Rules Near Noise Sensitive Areas" was adopted by the FAA in 1984, the same year the Wyoming Wilderness Act was signed into law by President Ronald Reagan. The advisory circular continues to have the support of the Aircraft Owners and Pilots Association.

A review of U.S. Geological Survey maps indicates that in order to comply with the FAA's "Visual Flight Rules Near Noise Sensitive Areas," a helicopter flying the proposed Teton County scenic tour route would have to fly an altitude in excess of 12,500 feet MSL for roughly one-third of each 30-minute tour flight, or about 10 minutes per flight. This results from the configuration of the high peaks and narrow valleys along the proposed scenic tour route. The FAA visual flight rules in Advisory Circular AC-91-36 call on pilots to fly 2,000 feet above the "surface" of national wilderness areas. The "surface" is defined in a note to the advisory circular as the highest terrain within 2,000 feet laterally of the route of flight or the uppermost rim of a canyon or valley. (See Appendix 8 on page 47 for excerpts of Advisory Circular AC-91-36.)

Each time a pilot climbed above 12,500 feet MSL to conform with the FAA's visual flight rules, he or she would risk being affected by a shortage of oxygen -- a matter that has long been a safety concern for the FAA. Research sponsored by the FAA's Civil Aeromedical Institute has found that pilots are subject to experiencing mild hypoxia at 12,500 feet MSL and higher. Sometimes this causes impairments in performance that the pilots can't recognize.

Based on experience with scenic tours in other states, it seems reasonable to expect that a Vortex Aviation pilot might fly an average of 10 half-hour tours each day, five days a week, along the proposed Teton County route. This works out

to 600 tours in a 12-week summer season. Under the assumption that the pilot would be flying 10 minutes above 12,500 MSL on each tour, he or she would be flying 6,000 minutes (i.e. 100 hours) above 12,500 feet MSL in a 12-week period without supplemental oxygen. The cumulative effect of this much short-duration mild hypoxia on a pilot over a protracted period is something that the FAA's Civil Aeromedical Institute is not known to have studied in depth.

Even if the pilot of a Teton County heli-tour were to fly as low as possible over the proposed route and ignore the FAA's voluntary "Visual Flight Rules Near Noise Sensitive Areas," he or she would still have to overcome major safety challenges on a daily basis in order to avoid crashing. Thin air at altitudes over 9,000 feet MSL affects helicopter engine performance and also reduces the lifting action of the main rotor. If the air gets too thin on a warm day, a pilot who is not an expert in mountain flying could easily find that he or she has exceeded the limits of the height-velocity envelope specified in the manufacturer's flight manual. Even without an engine failure, the helicopter could begin to settle in its own downwash at up to 3,000 feet-per-minute toward the cliffs below -- a condition known as settling with power. To recover in time to avoid a crash, a pilot would have to execute a difficult and perfectly timed maneuver to regain control. Either the pilot would have to autorotate to a lower altitude or else dip the nose and gain just the right amount of airspeed. If the pilot's timing were off even slightly at high altitudes MSL, the weight of the helicopter could carry it and its passengers down into the side of a mountain.

Scenic tour pilots could be especially prone to the risk of settling with power because a big part of their job is trying to please the passengers. The proposed Teton County heli-tour route traverses thousands of acres of summer high-elevation habitat for elk, moose, bighorn sheep, mountain lions and bear. Whenever the pilot or passengers spotted wildlife, the pilot would be tempted to slow down and hover so passengers could take photographs. But attempting to hover out of ground effect at these altitudes MSL can cause a helicopter to settle with power.

The FAA, the NTSB and aviation safety experts around the world use a concept called “density altitude” to determine whether a given helicopter can safely fly a given route on a given day. The “density altitude” is calculated through a formula that takes into account actual altitude MSL, air temperature, humidity and barometric pressure. Aviation authorities in New Zealand are especially sensitive to problems of mountain flying because over half of the country is mountainous terrain. The New Zealand Civil Aviation Authority noted in a 1999 publication for pilots that "density altitude increases tend to have a more marked effect on helicopters" than on fixed-wing planes. It warned of these problems for helicopters: a) "control effectiveness reduces with increases in density altitude;" b) "rotor response will be slower when selecting a new altitude;" c) "autorotative performance is also degraded;" d) "in general the helicopter will be more unstable;" e) the helicopter will be more susceptible to retreating blade stall;" f) "the turning radius will increase;" and g) "as the rotor is less efficient at higher density altitude, the power required will increase and this combined with reduced engine power can cause a serious problem."

Based on a formula accepted by U.S. and international aviation safety experts, the authors of this report estimate that the “density altitude” during warm days along the proposed Vortex Aviation route could reach 12,000-14,000 feet -- an estimate that a representative of Vortex Aviation did not dispute in his response to a draft of this report. (See Appendix 12 on page 52 for the full text of the Vortex representative's response.) While helicopter flight is not impossible under these conditions, flying fully loaded heli-tours would stretch or even exceed the upper limit of safety for most helicopters -- especially when the pilot is not fully experienced in mountain flying. There are a few models of helicopters on the market specifically designed for “hot and high” use. But the announced plans by Vortex Aviation for Teton County scenic tours do not include the use of a helicopter manufactured to “hot and high” specifications.

For a preview of the hazards of "settling with power" accidents along the proposed Teton County heli-tour route, see Appendix 13 on page 54 for an NTSB report on a 1999 "settling with power" accident in Telluride, Colorado, when an inexperienced scenic tour pilot tried to hover at approximately 9,300 MSL when the density altitude was 12,000 feet.

A review of NTSB’s online database shows that high "density altitude” has been cited as a contributing factor by NTSB accident investigators in 10 warm-weather helicopter accidents in the western states over the past five years. (For details, see Appendix 3 on page 42.) In 60% of those accidents, the elevation at which the crash occurred was lower than the 9,600 foot passes over which the Vortex Aviation scenic tour helicopter would apparently have to cross hundreds of times each summer, in varying wind and weather conditions.

Even for fixed-wing aircraft, the wilderness terrain along and near the Vortex Aviation proposed route has not always been the safest place to fly:

- On August 17, 1996, a U.S. Air Force transport plane crashed at night into the top of Sheep Mountain in the Gros Ventre Wilderness Area while transporting equipment for a visit by then-President Bill Clinton. It took hundreds of rescuers and dozens of vehicles from Wyoming, Utah, Idaho and elsewhere to search for survivors. All eight crewmembers and a Secret Service agent were eventually found dead. The scattered wreckage can still be seen near the summit of Sheep Mountain (also known as the Sleeping Indian).
- On December 8, 1996, a private pilot en route to Jackson Hole crashed 300 feet below the 10,741-foot summit of Jackson Peak shortly after noon, killing the pilot and starting an avalanche that partly buried the Beech B36TC airplane. Jackson Peak, also in the Gros Ventre Wilderness Area, is seven miles south of Sheep Mountain. Before leaving Colorado, the pilot had received a weather briefing calling for unlimited visibility in Jackson, but later the weather deteriorated.
- On March 12, 2001, a private pilot en route to a family reunion in Jackson Hole crashed a single-engine Beech Bonanza airplane around noon near the top of 10,800-foot Pinnacle Peak, killing all four people aboard. The crash site was also in the Gros Ventre Wilderness Area, about six miles southeast of Sheep Mountain. It took rescuers more than 24 hours to reach the wreckage and determine that no one was alive. The impact point was at 10,400 feet elevation. The Wyoming Civil Air Patrol estimated that the cloud level was at 9,000 feet MSL at the time of the crash.

## IS THE AEROSPATIALE 350 SERIES HELICOPTER SAFE FOR WARM WEATHER, HIGH-ALTITUDE SCENIC TOURS?

Vortex Aviation managing member Mr. Gary Kauffman informed the Jackson Hole Airport Board in July 2000 that the company would use an Aerospatiale 350 Series helicopter for Teton County scenic helicopter tours. Mr. Kauffman said in March 2001 that this type of helicopter "is the aircraft of choice for virtually all air tour operators because of its safety record and passenger considerations." (For a full text of Mr. Kauffman's March 2001 remarks, see Appendix 12 on page 52.)

Here is some background on the Aerospatiale 350 Series helicopter:

- It is the civilian version of a French-made military observation helicopter known in Europe and Canada as the “Ecureil” (in English, “squirrel”). One of its distinguishing features is that the "Starflex" main rotor hub is made out of composite materials instead of metal. This helps make the Aerospatiale 350 Series lighter than many other brands of helicopters also designed in the 1970s.
- The first in the series, the Aerospatiale AS-350, flew in 1974 and was certified by the FAA for operations in the United States in December 1977. Since then, Aerospatiale and its overseas affiliates have introduced at least 11 variants: the AS-350B, BA, B1, B2, B3 and D, and AS-355E, F, F1, F2, and N. The Vortex Aviation helicopter is an Aerospatiale AS-350BA, a variant first sold in the early 1980s.
- As Vortex Aviation has noted, the Aerospatiale 350 Series is especially popular among scenic helicopter tour operators. It has extra-large windows, luxurious passenger compartments and a reputation for low operating costs. This reputation results in part from the fact that it carries one or two more passengers than many comparable American-made helicopters. In the United States, the Aerospatiale 350 Series has been assembled and marketed under the name “AStar” by American Eurocopter Corp. of Grand Prairie, Texas, the American subsidiary of the French helicopter manufacturer.

Here are factors to be considered in deciding whether an Aerospatiale 350 Series helicopter could be a risky choice for high-altitude backcountry scenic tours in Teton County:

**1) No Others in Wyoming**. The Rotor Roster 2001 database contains no record of any Aerospatiale 350 Series helicopter currently registered in Wyoming, nor to any out-of-state company that offers search-and-rescue service in Teton County, Wyoming. Does this suggest that the pilots with the most experience in mountain flying in Teton County are not persuaded that the Aerospatiale 350 Series helicopter is the best choice for local conditions? Does it suggest that there is no cadre of experienced Aerospatiale mechanics in the Teton County area?

**2) Pattern of Fatal Crashes in Other Scenic Tours**. Four of the five most deadly U.S. civilian helicopter accidents in the last ten years involved scenic tours in Aerospatiale 350 Series helicopters. Seven died in a crash in Hawaii in 1992; six more in Hawaii in 1998; seven in Alaska in 1999, and seven in Hawaii in 2000. All four of these Aerospatiale 350 Series accidents occurred in the summer months in mountainous terrain, but the elevations at the crash sites were not nearly as high as elevations along the route of the proposed scenic tours in Teton County. (See Table 1 on page 8 and Appendices 1 and 2 on pages 34-42 for details.)

**3) How "Crashworthy" Is This Kind of Helicopter?** A starting point for such an inquiry might be the February 23, 1995, article in the Boston Herald, headlined "Copter Model No Stranger To Trouble; 20 Have Been Killed in Past Accidents." The article, by Laura Brown and David Weber, appeared one day after an Aerospatiale 350 Series helicopter owned by the Massachusetts State Police crashed into a boathouse near Cambridge, Massachusetts. All four Massachusetts state troopers aboard were killed. Seeking background on this type of helicopter, one of the Boston Herald reporters talked with a number of authorities on helicopters, including Lt. David Aikins of the Los Angeles Police Department's aviation bureau. The reporter asked details about the crash of an Aerospatiale 350 Series helicopter four years earlier in which two LAPD officers were killed. The Boston Herald article contained this quotation: " . . .one high-ranking LAPD official said the Astar still has an inferior crash survivability rating compared to the McDonald Douglas 500E copter. . . . "

To check out the LAPD official's reported suggestion that the Aerospatiale 350 Series helicopter had an "inferior crash survivability rating" compared to another make of helicopter, the authors of this report made comparisons based on the 1,890 U.S. helicopter accidents over the last 10 years. Here were the results:

- Aerospatiale 350 Series helicopters have **not** proven to be more prone to accidents than were other helicopters in U.S. civilian use. Over the last decade, about one out of every 20 civilian helicopters has been an Aerospatiale 350 Series helicopter -- and Aerospatiale 350 Series helicopters have been involved in about one out of every twenty helicopter accidents. In other words, the two percentages have remained roughly the same. (See Tables 4 and 5 on page 15 for an analysis.)

- Yet accidents involving Aerospatiale 350 Series helicopters appear to have been **deadlier**, on the average, than typical helicopter accidents. (See Tables 4 and 5 on page 15 for an analysis; see also Appendix 4 on page 43 for a list of 21 Aerospatiale 350 Series accidents over the past five years for which the NTSB has not determined the cause. The casualty toll in these 21 accidents with undetermined causes totaled 26 deaths and 19 injuries.)

    - ✓ Over the last three years, only about 5% of all civilian helicopters in the U.S. have been Aerospatiale 350 Series helicopters. Yet 19% of all deaths in helicopter crashes have occurred in Aerospatiale 350 Series helicopters.

    - ✓ For every Aerospatiale 350 Series helicopter accident over the last decade there was one death -- in other words, there was a ratio of one death for every Aerospatiale 350 Series accident. The ratio of deaths to accidents for all brands of helicopters was much lower -- only one death for every three accidents.

**TABLE 4**

**DEATHS IN U.S CIVILIAN HELICOPTER ACCIDENTS**
**AEROSPATIALE 350 SERIES HELICOPTERS vs. ALL HELICOPTERS**
**(1991-2000)**

| | LAST 3 YEARS 1998-2000 | LAST 5 YEARS 1996-2000 | LAST 10 YEARS 1991-2000 |
|---|---|---|---|
| **AEROSPATIALE 350 SERIES HELICOPTERS** | | | |
| Accidents (total) | 37 | 46 | 82 |
| Fatal Accidents (total) | 13 | 15 | 28 |
| Deaths (total) | 38 | 43 | 80 |
| Ratio of Deaths to Accidents | 1.0 | 0.9 | 1.0 |
| % of all Accidents Are Fatal | 36% | 33% | 34% |
| **ALL MAKES OF HELICOPTERS** | | | |
| Accidents (total) | 613 | 946 | 1,890 |
| Fatal Accidents (total) | 106 | 161 | 337 |
| Deaths (total) | 203 | 295 | 632 |
| Ratio of Deaths to Accidents | 0.3 | 0.3 | 0.3 |
| % of all Accidents Are Fatal | 17% | 17% | 18% |
| **AEROSPATIALE 350 SERIES HELICOPTERS AS SHARE OF ALL HELICOPTER ACCIDENTS** | | | |
| % of All Helicopter Accidents | 6% | 5% | 4% |
| % of Fatal Helicopter Accidents | 11% | 9% | 8% |
| % of All Helicopter Deaths | 19% | 15% | 13% |

Source: records found at http://www.ntsb.gov/NTSB/query.asp.

**TABLE 5**

**AEROSPATIALE 350 SERIES REGISTRATIONS vs. TOTAL U.S. HELICOPTER REGISTRATIONS**
**(BY YEAR)**

| | 2000 | 1998 | 1995 | 1991 |
|---|---|---|---|---|
| Aerospatiale 350 Series helicopters | 519 | 564 | 548 | 516 |
| All Helicopters | 11,409 | 10,781 | 9,712 | 9,477 |
| Aerospatiale 350 Series as % of all helicopters | 4.5% | 5.2% | 5.6% | 5.4% |

Source: Rotor Roster database.

# WHAT IS THE SAFETY RECORD OF THE PARTICULAR HELICOPTER PURCHASED FOR TETON COUNTY SCENIC HELI-TOURS?

At least 95% of the 11,409 civilian helicopters registered in the 50 states have never been involved in an accident. However, the helicopter purchased for use in Teton County scenic tours is not one of the accident-free majority. It has twice suffered damage in two somewhat similar mishaps in which the tail rotor struck objects on the ground during landing. The cause of the latest event, classified by the NTSB as an "accident," remains under investigation.

The helicopter, an Aerospatiale AS-350BA model, has the serial number 2152 and the registration number "N189ND" painted on its tail. In 1988 it was manufactured as an AS-350B1 model. In 1995 it was upgraded to an AS-350BA model through a conversion procedure authorized by the manufacturer.

On August 7, 1998, the helicopter was damaged during a practice landing at Grand Forks International Airport, North Dakota. The damage occurred when its tail rotor hit a plastic traffic cone used to mark the landing zone. The episode was categorized as an "incident" by the FAA. But according to the FAA incident database, "a post flight inspection revealed damage to the tail rotor assembly which was determined to be unairworthy by the manufacturer." The helicopter was then owned by the University of North Dakota.

The helicopter was repaired and put back into service. It was sold by the University of North Dakota to Vortex Helicopters LLC ("Vortex Helicopters") in May 2000. Vortex Helicopters, a company that sells and leases helicopters, is closely affiliated with Vortex Aviation, the prospective Teton County heli-tour operator. The two companies shared the same address, phone number and fax number in El Cajon, California. Mr. Gary Kauffman was listed in aviation industry publications as a principal figure in both companies.

Mr. Kauffman, the chief pilot and managing member of Vortex Aviation, flew the helicopter to the Jackson Hole Airport for one of his appearances before the Jackson Hole Airport Board in July 2000. He told the Airport Board that this is the helicopter he intended to use for Teton County scenic air tours. Later in the summer of 2000 the helicopter was flown back to the Vortex Aviation home base in California, and that is where it crash-landed on October 3, 2000.

No one was injured in the accident. But a preliminary report in the NTSB database said that the helicopter, operated at the time by Vortex Helicopters, suffered "substantial damage." The preliminary NTSB report said the helicopter slammed into the tarmac during an attempted landing at Gillespie Field Airport in El Cajon, California, the home base of Vortex Aviation and Vortex Helicopters. The pilot later told an NTSB investigator that he “saw something fly off the helicopter” near the tail rotor and that he then made what he called a “hard landing.” However, two witnesses told an NTSB investigator that they saw a part come off the tail rotor only after the descending helicopter’s tail boom struck a landing cart parked on the ground.

By mid-March 2001, the tail rotor assembly of the helicopter had evidently been repaired or replaced. This became apparent when Vortex Helicopters put the helicopter up for sale on its website. The website listed an "asking price" of $690,000 and included a photograph of the helicopter taken at Jackson Hole Airport in the summer of 2000 with the Tetons in the background.

The NTSB has not issued a final report on what caused the part to fly off the tail rotor. But on March 21, 2001, an article in the Jackson Hole Guide newspaper quoted a Vortex Aviation spokesman as saying: "Although the helicopter suffered damage, Mr. Kauffman safely landed the helicopter when the tail rotor failed due to faulty maintenance under the aircraft's previous owner."

(Sources: For the text of the NTSB preliminary report on the damage in 2000 to the Vortex helicopter, see Appendix 5 on page 45 or find it at http://www.ntsb.gov/NTSB/query.asp. To find the FAA report on the 1998 damage to the University of North Dakota helicopter, go to http://nasdac.faa.gov/asp/asy_fids.asp and search the FAA incident data system database by entering "189ND" in the box labeled "registration." To monitor whether Vortex Helicopters has sold the helicopter purchased for use in Teton County helicopter tours, see http://www.vortexhelicopters.com. Information on the transfer of ownership from the University of North Dakota to Vortex Helicopters is available from the Aircraft Registration Branch of the FAA in Oklahoma City, Oklahoma.)

# IMPROVING CHANCES OF RESCUE IN THE WYOMING BACKCOUNTRY

Search-and-rescue professionals agree that the difference between survival and death can be measured in the number of minutes it takes to get to the emergency room. That means search-and-rescue teams need the benefits of the most modern and reliable technology.

The FAA rules governing the proposed Teton County heli-tours, known as Part 135, do not require that helicopters carry an emergency beacon designed to begin sending out a position report when triggered by the impact of a crash. However, like most of today's helicopters, the Aerospatiale 350 Series models ordinarily are equipped with factory-installed Emergency Locator Transmitters (ELTs). According to http://www.vortexhelicopters.com, the website of Vortex Helicopters, the helicopter intended for Teton County heli-tours is equipped with an ELT.

Just having an ELT may not be enough, however.

The dangers resulting from malfunctioning ELTs have long been known to aviation safety experts around the world. The NTSB issued a special investigative report in 1978 on malfunctioning ELTs in all categories of aircraft, noting a "large number" of failures and false signals. (See "Sourcing" on page 54 to obtain this document.) Since then, aviation authorities in the United States, Canada and New Zealand have continued to find a pattern of malfunctions in the ELTs after helicopter crashes, notably including crashes of Aerospatiale 350 Series models. In Canada, the United States and New Zealand, there are at least 10 cases over the last seven years in which the ELTs on Aerospatiale 350 Series helicopters were destroyed or damaged on impact, sometimes delaying rescues by hours or even days. ELT failures have regularly occurred in other makes of helicopters as well.

Fortunately, most helicopter crashes do not occur in remote high-elevation wilderness terrain like that planned for Teton County heli-tours. But when helicopter crashes have occurred in remote terrain, the consequences of ELT failure have sometimes been drastic. One such episode occurred when an Aerospatiale 350 Series medevac helicopter crashed in the uninhabited tundra near Kuujjuaq in Canada's Quebec Province on September 24, 1994. Its ELT failed to function. Even though the wreckage was just 38 miles from an airport, it took Canadian search-and-rescue teams five days to find the wreckage. The helicopter's four occupants were found dead. "Had any of the passengers survived the impact, it is unlikely that they would have survived the five-day wait for search and rescue personnel to find them," the Transportation Board of Canada said in a report that called for a better level of crashworthiness for ELTs and their associated antennas.

In September 1999, the crash of an American-registered Aerospatiale 350 Series helicopter flying a scenic tour over glaciers near Juneau, Alaska, led to an NTSB investigation of safety procedures during flights over remote territory in bad weather. The helicopter's ELT didn't function, and as a result it took rescuers more than 18 hours to bring the injured pilot and five injured passengers to safety. Two other helicopters crashed onto the same glacier during the search-and-rescue mission due to poor visibility.

In the concluding section of its post-accident investigation report, the NTSB noted that the heli-tour operator, Temsco Helicopters, had decided to install more crashworthy ELTs for scenic flights over glaciers. The NTSB reported that Temsco also planned to install portable ELT antennas in all tour helicopters "in the event the airframe mounted antenna or antenna wiring is damaged" and also portable hand-held FM radios in case the helicopter's radios were destroyed in a crash.

Table 6 on page 18 reports the results of a search of the NTSB accident database about the likelihood of ELTs functioning after helicopter crashes.

**TABLE 6**

**FUNCTIONING OF EMERGENCY RADIO BEACON IN MAJOR CRASHES**

**(1991-2000)**

| | Heli-Tour Accidents (in all makes of helicopter) | Aerospatiale 350 Series Accidents (heli-tours and all other uses) |
|---|---|---|
| ELT did work | 32% | 45% |
| ELT did not work | 40% | 39% |
| Unknown if ELT worked | 8% | 12% |
| No ELT installed | 20% | 3% |

Source: NTSB accident reports found in http://www.ntsb.gov/avdata/ database. Included in this tabulation are only reports concerning accidents a) involving deaths or injuries and b) when the NTSB report contains data on whether the helicopter was carrying an ELT.

## USING BETTER TECHNOLOGY TO AVOID CRASHES IN FOG

The skies are usually clear and sunny in Teton County, Wyoming, in the summer. But not always. The mountains along the proposed Vortex Aviation scenic touring route are quite often fog-enshrouded for part of the day. Every summer there are thunderstorms, hail storms and even snow storms over the Gros Ventre Wilderness and the Tetons. The weather in the mountains changes rapidly and unpredictably. It can be stormy on the east side of Sheep Mountain when it is sunny at the Jackson Hole Airport, and vice versa. In the Teton Range, the weather at high elevations is notoriously changeable. So it is almost inevitable that a scenic helicopter tour pilot will sometimes fly in fog close to jagged mountains even if the pilot has every intention of flying only when the weather is clear.

Table 7 on page 19 lists six fatal accidents with 18 total deaths over the last five years in which fully certified pilots crashed helicopters into mountainsides during foggy conditions without the pilots having any advance awareness of an impending crash. These crashes are in many ways similar to the pattern of so-called CFIT crashes (Controlled Flight Into Terrain) that has recently persuaded the FAA to order the installation of Terrain Awareness and Warning System (TAWS) devices all U.S.-registered turbine-powered airplanes with six or more passenger seats. A TAWS device backstops a pilot's eyes in bad weather by automatically providing the pilot what the FAA calls a "terrain clearance envelope" to protect against CFIT crashes. The new rule became effective for airplanes on March 29, 2001.

When used in scenic air tours, the Aerospatiale 350 Series helicopter is often configured with six passenger seats. Yet in response to complaints from the helicopter industry and the scenic air tour industry, the FAA has announced that helicopters would be exempted from this rule for the time being. This means that any potential Wyoming scenic tour operator would be under no legal obligation to install a TAWS system, even though such a system would improve passengers' chances of avoiding accidents in fog during high-altitude MSL scenic tours.

Without a legal obligation, some helicopter scenic tour operators have recognized a need to give their pilots better equipment to avoid crashing in fog. Following the September 1999 crash of an Aerospatiale 350 Series helicopter in Juneau, Alaska, and subsequent crashes of the two rescue helicopters, the NTSB found that the initial accident

happened after the pilot had become disoriented during fog and whiteout conditions. In its accident report, the NTSB noted that none of the helicopters was equipped with radar altimeters, "nor were they required to be."

In the concluding section of the report, the NTSB noted that the tour operator, Temsco Helicopters, had decided to put radar altimeters in all of its scenic tour helicopters flying over the snow-covered glacial terrain. A radar altimeter is a device that allows the pilot to see a read-out of the exact distance between the helicopter and the nearest obstacle below.

**TABLE 7**

**FATAL HELICOPTER ACCIDENTS INVOLVING FOG AND STEEP TERRAIN**

**(1996-2000)**

| Date | Place | Deaths | Type | Scenic Tour? |
|---|---|---|---|---|
| 8/27/97 | Dillingham, Alaska | 1 | Bell 206B | No |
| 9/12/97 | Sequim, Washington | 3 | Bell 205A-1 | No |
| 6/9/99 | Juneau, Alaska | 7 | Aerospatiale AS-350BA | Yes |
| 6/14/99 | Jackson, Kentucky | 4 | Sikorsky S-76A | No |
| 8/7/99 | Westford, Oregon | 1 | Schweizer 269C | No |
| 9/7/00 | Waynesville, North Carolina | 2 | Bell UH-1H | No |

Source: NTSB database at http://www.ntsb.gov/NTSB/query.asp

## WHO WILL RESCUE PASSENGERS IF A SCENIC TOUR HELICOPTER CRASHES IN REMOTE TERRAIN?

Established scenic helicopter tour operators in Alaska and Hawaii have found it crucial to mobilize backup helicopters rapidly for search-and-rescue efforts. Judging from NTSB accident reports, they have usually done this by dispatching backup helicopters from their own fleets of scenic helicopters.

Vortex Aviation's managing member, Mr. Gary Kauffman, told the Jackson Hole Airport Board in the summer of 2000 that it planned to base one helicopter at the Jackson Hole Airport. He mentioned no plans to lease a backup helicopter for a search-and-rescue mission in case his only helicopter in Wyoming were to crash or have an emergency landing in the Teton County backcountry. As Mr. Kauffman told the Jackson Hole Airport Board, it can be extremely difficult to find a spare helicopter in Jackson Hole during the summer months. Thus without advance arrangements, it could be hours before a search-and-rescue helicopter would become available, especially if the Vortex Aviation helicopter were to crash or make an emergency landing in the back country at a time when all available helicopters were committed to search-and-rescue, fire-fighting or other duties. For Vortex Aviation's pilot and passengers, the length of the delay could be a matter of life or death.

# PART TWO

# THE RISKS OF ENVIRONMENTAL AND WILDLIFE HARM FROM SCENIC HELICOPTER TOURS

## HISTORIC "SAFE HOUSES" FOR NATURE ARE UNDER THREAT

Solitude, space, the sounds of nature and the sound of silence are scarce commodities in our world today. All have been held in trust in our national parks since Congress began the national park system by creating Yellowstone National Park in 1872. More recently, the Wilderness Act of 1964 assured protection to millions of acres to keep America's wild land and its wild inhabitants free from the destruction spread by human development. National wildlife refuges have been set up over the decades under the U.S. Fish and Wildlife Service to create additional sanctuaries for creatures that it is feared cannot accommodate to the stresses of our mechanized society, to the encroachment of human beings.

Teton County, Wyoming, has the serendipitous good fortune to hold an irreplaceable collection of these critical "safe houses" for nature and its human guests: Grand Teton National Park, Yellowstone National Park, the National Elk Refuge, the Gros Ventre Wilderness, the Jedediah Smith Wilderness, the Teton Wilderness and the Winegar Hole Wilderness. Despite the protections guaranteed by the law and by government regulation, a relatively new danger threatens the wildlife that is supposed to be secure in such havens. The clamorous scenic heli-tours that have proliferated over other nature reserves can disrupt the lifestyles and even life cycles of wildlife. Professional managers of these other areas have reported widespread disturbance caused by low-flying aircraft, with the most severe reactions provoked by helicopters. Heli-tours also threaten to spoil for Americans and foreign visitors the taste of our natural history promised to be kept fresh for us and for future generations to savor.

Congress, the FAA and other government agencies have both the power and the responsibility to make good those promises and to save this unique American heritage in one of the few places it remains intact.

More than eight years ago, during the administration of President George Bush, the FAA recognized the rising concern over both the safety and the noise of scenic tours. It was in 1992 that the FAA acknowledged that the procedures of the National Environmental Policy Act might have to be followed in the establishment of scenic tour operations. In giving its principal operations inspectors (POIs) written guidance on dealing with air tour operators, the FAA said: "An environmental impact study may be required for any route developed below 3,000 feet above ground level." (See FAA Handbook 8400.10 - Bulletin 92-01, reproduced as Appendix C in the NTSB's 1995 "Special Investigation Report: Safety of the Air Tour Industry in the United States.") Earlier, during the presidency of Ronald Reagan, the FAA wrote in a 1985 study on aviation noise that it is "important to remain aware of the issue and alert to the possibility that `off-limits' wildlife areas may be desirable in the future for selected wildlife areas."

It is more than 15 years since that report was published. The time has come to mandate "off-limits" areas in Teton County, both to protect wildlife and preserve a rare experience for the human animal. At present no scenic heli-tours are taking place in Teton County. However, Vortex Aviation has said it plans to begin tours in 2001, probably in June, and has signed a contract with the Jackson Hole Airport Board. The Board members were so reluctant to grant this contract that they ordered a temporary ban on heli-tours in the summer of 2000. The question of air tours is complicated in Jackson by the fact that the Jackson Hole Airport is the only airport in the contiguous 48 states to be located inside the boundaries of a national park -- Grand Teton National Park. Thus even if a tour operator advertised a sightseeing route outside the park, the tour helicopter would travel over parklands each time it took off and landed at

the Jackson Hole Airport. The proposed route for Teton County helicopter tours would pass over or near Blacktail Butte, a key geographic feature of Grand Teton National Park.

Despite almost unanimous community support for the heli-tour moratorium, the FAA told the Airport Board on October 27, 2000, that the Board had no authority to maintain the temporary ban. Absent a specific federal rule in support of a ban, or even any rule in support of rational regulation of heli-tours over this dangerous and sensitive terrain, the Board had no choice but to approve a contract permitting scenic heli-tours. In view of the FAA's exclusive jurisdiction over the airspace of the United States, the Airport Board was without power to require a single limit as to minimum altitude AGL, frequency of flights or geography to be covered.

Congress and the FAA do have the power to limit or prohibit heli-tours in national parks. The FAA's power was granted by Congress in 49 U.S.C. 40103(b)(2) and 49 U.S.C. 44715. By adopting Special Federal Aviation Regulation No. 78, the FAA temporarily banned commercial air tour operations over Rocky Mountain National Park (RMNP) "to preserve the natural enjoyment of visitors to RMNP by preventing any potential adverse noise impact from aircraft-based sightseeing overflights." The Congress made that ban permanent in Section 806 of the National Parks Air Tour Management Act of 2000. (See Appendix 7 on page 46 for excerpts of SFAR No. 78 protecting Rocky Mountain National Park, Colorado.)

## IS THIS THE SEED OF A MONSTER WEED?

A single scenic tour helicopter running multiple tours every day would impinge on the unique environment maintained in these special natural areas. But experience elsewhere has shown the air tour business proliferates dramatically and quickly once it sinks a root:

- In Hawaii between 1982 and 1994, the number of heli-tour passengers rose from fewer than 184,000 to more than half a million, with a commensurate increase in the volume of flights as well as accidents. The number of air tour helicopters jumped from 35 to 82. By 1997, the number of heli-tour passengers exceeded 900,000, according to the Helicopter Association International (HAI).

- In Glacier National Park the number of fixed wing and heli-tours increased from 100 to 800 between 1986-1996.

- At Mount Rushmore National Memorial, the National Park Service estimates the number of overflights has increased from 2,400 to 4,000 a year. All tour operators use helicopters, and most tours are concentrated in summer months at the rate of approximately 30 per day.

- At Grand Canyon National Park air tour overflights increased from a few hundred in the 1960s to 40,000-50,000 a year in 1986 to 80,000-95,000 a year in 1996. Visitors to the park are subjected to the annoying drone of helicopters at least 50 percent of the time they are at the Grand Canyon.

(Source: "FAA Special Flight Rules in the Vicinity of the Rocky Mountain National Park," Federal Register, Jan. 8, 1997, p. 1191, available at http://www.airportnet.org/depts/federal/rules/rocky.htm, and HAI's website - www.rotor.com.)

## THE RISKS OF FOREST FIRE

There is no reason to believe that the pristine forests and wildlife of Wyoming will remain untouched by accidents once scenic helicopter tours begin. Over the last decade scenic tour helicopters have crashed in almost every scenic locale that has attracted heli-tours: the volcanoes of Hawaii, the glaciers of Alaska, Mount Rushmore, Grand Canyon, Bryce

Canyon, Santa Catalina Island, Fort Walton Beach, Great Smoky Mountains National Park, Niagara Falls and New York City.

A backcountry helicopter crash in Teton County, Wyoming, could be a human tragedy. Statistics suggest it could also touch off a devastating forest fire.

All too often, fuel lines rupture when a helicopter crashes. This allows the fuel to catch fire, melting the fuel tanks, consuming the helicopter and whatever is near the wreckage. There have been 68 helicopter accidents that resulted in fires on the ground over the last five years, according to the NTSB database. That represents one out of every 10 of all the helicopter accidents for which the NTSB has complete data.

Here is some evidence taken from the NTSB database suggesting that a helicopter crash in the Wyoming backcountry could easily spark a forest fire, especially during the often dry July-September period which will be the peak season for tourists who may be interested in helicopter tours:

- **November 12, 1995** - A Bell 47-D1 helicopter crashed on a field of freshly planted roses on a farm in Shafner, California. The resulting fire destroyed 10 acres of roses.
- **September 19,1997** - A Bell 47G helicopter crashed into a tree in Saluda, South Carolina. A ground fire not only destroyed the helicopter but burned "several acres of surrounding bush."
- **October 5, 1998 -** A Robinson R-22 helicopter crashed into an open meadow near Lower Lake, California. "The fire spread from the aircraft to the surrounding dry grass," said the NTSB report. It added: "...the fire ultimately covered an area of about 6 acres before being extinguished."

In other instances, fires were kept from spreading because the crashes occurred near populated areas. Neighbors or the local fire department quickly reached the scene and helped quench the flames.

Sometimes, it was simply a matter of luck that fires didn't spread beyond the wrecked fuselage. On July 22, 1995 a Bell 206-L3 helicopter crashed into dry, grassy terrain in Borger, Texas. The grass beneath the helicopter caught fire and the flames of an "intense fire" began to spread. "It was extinguished almost immediately after impact, from the onset of heavy rain," the accident report stated.

That kind of a timely "onset of rain" might be the only thing that could prevent a forest fire if a scenic tour helicopter crashed in a forested area of Grand Teton or Yellowstone National Parks or one of Teton County's four wilderness areas when the forest fire danger index is at its highest.

On July 21, 2000, a scenic helicopter tour crashed in a mountain forest in Hawaii's Iao Valley. This is a part of Maui that is described in the NTSB accident report as having a reputation for receiving the second-highest amount of rainfall of any place on earth. The Aerospatiale 350 Series helicopter was consumed in the flames and all seven people aboard were killed. But because the Iao Valley was so wet, the flames did not spread from the wreckage to the forest.

A major forest fire could start if the same accident were to occur in equally mountainous terrain in Teton County, Wyoming. A house consumed by fire can be rebuilt in less than a year. After a forest fire, decades are required to grow enough trees just to shade a single house.

The history of recent summer forest fires in the west suggests that, once sparked by a helicopter crash, a fire could spread over thousands of acres and burn millions of trees. The U.S. Forest Service would then face a choice of letting the fire burn itself out or spending hundreds of thousands of taxpayer dollars to fight it.

## HELICOPTERS AND WILDLIFE DON'T MIX

Wildlife biologists and other experts who work daily in the field are eyewitnesses to the effects that touring helicopters have on wild birds and mammals. Some animals seem virtually unaffected. Others, such as bighorn sheep, grizzly bears and caribou, are described as having their feeding, breeding or other habits suddenly disrupted upon catching the first whine of an approaching helicopter (which may happen considerably before the human ear picks up the noise). Birds

that tend to flush when disturbed by a helicopter, including the snow goose and brant, may be particularly susceptible to harm when nesting. Both the U.S. Fish and Wildlife Service and U.S. National Park Service have reported that frantic flight from the nest may dislodge eggs or vulnerable babies, sending them crashing to the ground or into the grip of a predator. Young ungulates have been endangered during animal stampedes caused by helicopter overflights. The simple interruption of feeding can have serious ramifications for animals that must spend most of their waking hours foraging and eating to survive. Rare species, such as the grizzly bear and lynx, are threatened largely because their habitat is disappearing. If they are driven from appropriate habitat out of fear or annoyance, where can they go?

The habits of wildlife and the extensive size of the national parks, wilderness areas and refuges make it difficult to conduct scientific studies on the impacts of helicopter overflights. These studies also take money and time, especially to determine long-term effects of environmental variables on sensitive animal systems such as reproduction. But there have been rigorous reports that suggest that the lower the altitude AGL of helicopter overflights, the greater are the effects on wild animals.

The Fish and Wildlife Service surveyed its field personnel in 1988, asking for their observations of aircraft impact on fish and wildlife. The resulting report concluded that aircraft cause disturbances over a wide geographic area. And it said that "helicopters appear to cause a greater flight/fright response in wildlife than fixed-wing aircraft." The report found that waterfowl were the animals most frequently reported to be disturbed by aircraft, but noted that the high incidence of reports may reflect the fact that waterfowl are highly visible, as well as sensitive to aircraft disturbance. "Clearly, additional research is needed to determine if more secretive, less conspicuous bird species also are being adversely affected by aircraft," the report said.

One of the most unsettling findings is that the FAA's recommendation to pilots that aircraft maintain a minimum altitude of 2,000 feet AGL above a national wildlife refuge "is frequently violated." In other words, the conclusion of the federal agency that oversees the National Elk Refuge in Teton County is that voluntary limits often have not worked.

## …SOME FINDINGS FROM THE NATIONAL REFUGES

- Several refuges reported that low-altitude AGL aircraft have caused ungulates to stampede, for instance desert bighorn sheep at Desert National Wildlife Refuge and pronghorn antelope at Hart Mountain and Sheldon National Wildlife Refuges. Concern was expressed for potential adverse effects of low-altitude AGL aircraft over fawning/calving grounds, for instance of Sonoran pronghorn antelope at Cabeza Prieta National Wildlife Refuge and of barren ground caribou at Selawik National Wildlife Refuge. (Pronghorns are widespread in Wyoming; bighorn sheep live beneath the route proposed by Vortex Aviation for Teton County heli-tours.)

- A wildlife refuge in Texas reported low altitude AGL helicopter flights have been so disturbing that the refuge is "virtually unused by waterfowl, particularly snow geese." In Alaska's Arctic National Wildlife Refuge, heli flights have caused flight/fright behavior in tundra swans and snow geese, and swans have abandoned nests due to the disturbance. (Both the snow goose and the trumpeter swan are found in Teton County. Trumpeters spend summer months in the National Elk Refuge, beneath the route proposed by Vortex Aviation for Teton County heli-tours.)

- An Ohio wildlife refuge reported "birds are more likely to leave the area completely when disturbed by helicopters," compared to departing for 5-10 minutes after a fixed wing flight or for a few hours after a series of fixed wing flights. The Bombay Hook refuge in Delaware also reported helicopters seem to have a "more pronounced impact on waterfowl and big game" than do repeated airplane overflights.

(Source: "Effects of Aircraft Noise and Sonic Booms on Fish and Wildlife: Results of a Survey of the U.S. Fish and Wildlife Service Endangered Species and Ecological Services Field Offices, Refuges, Hatcheries and Research Centers" can be found at http://www.nonoise.org/library/fishwild/survey.htm.)

Another research study, jointly undertaken by the U.S. Air Force and the Fish and Wildlife Service, surveyed the literature from studies about the effect of aircraft noise on domestic animals and wildlife. One conclusion was that sudden or unfamiliar sounds, acting as an alarm, can produce reactions of stress that vary among species. But the general pattern of response to stress includes activation of the neural and endocrine systems, causing changes such as increased blood pressure, available glucose, and blood levels of corticosteroids. "Prolonged exposure to severe stress may exhaust an animal's resources and result in death," according to the Air Force and Fish and Wildlife Service.

Their report also found that aircraft noise has been linked to lower reproduction in a variety of animals. While much research up until the time of this survey had been conducted on domestic animals in laboratories, the authors said field studies indicate the effects may be more severe among wild animals as a result of disturbance of the animal's behavior during the reproductive cycle. The exertion required when an ungulate suddenly flees upon hearing a helicopter was given as an example of a serious effect. Increased expenditures of energy reduce the rate of reproduction and of survival, the report said. Under good conditions, an animal well may be able to restore the losses by eating more. But that is not always possible under difficult conditions of winter or drought when forage is hard to find, the report said.

Two studies cited in this report are of special concern in Teton County since they described how helicopter flights affected bald eagles. The bald eagle, once threatened with extinction, has begun successfully breeding in the park, forest and wilderness areas of Teton County. Threats to the future of America's national bird must be taken seriously. The proposed heli-tour route in Teton County passes over the nests of at least three pairs of bald eagles.

A 1985 study at Bellingham International Airport in Whatcom County, Washington, assessed the effects of aircraft flights on bald eagle population and habitat in the area. It found that all forms of flights stirred a reaction among the eagles only 12 percent of the time. But helicopters and small jets had much greater effect on bald eagles, with helicopters bringing reactions 40 percent of the time and small jet aircraft 55 percent of the time.

A second study on bald eagles raised more detailed concerns. It involved helicopter observations of bald eagles, golden eagles, peregrine falcons, gyrfalcons and rough-legged hawks nesting on cliffs or hillsides in Alaska. The researchers found that when suddenly surprised by a helicopter popping over the top of a cliff, these birds usually panicked and made a frantic escape. It found birds to be least disturbed when the aircraft flew parallel to the cliff at an initial distance of about half a mile away, making a gradual approach toward the nest.

The report went on to describe the need for a most sensitive interplay between aircraft and bird to avoid harm:

> Disturbance just before egg laying, during egg laying, and during incubation were more deleterious than disturbance during the nesting stage. White and Sherrod (1973) recommended helicopter surveys of nesting raptors after the young had hatched, but before the young were ready to fledge. The presence of a helicopter too close to a nest late in the nesting season may force young birds into premature fledging. Fair-weather days were recommended over inclement weather for clearer observation and to avoid chilled eggs or young if the adults are flushed off the nest in cold, wet weather. Experienced pilots, familiar with maneuvering the aircraft in wind drafts, were also recommended. Approach from upwind is preferred, to avoid inadvertently flushing birds into the helicopter.
>
> (Source: "Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis," a cooperative research project by the U.S. Fish and Wildlife Service National Ecology Center in Fort Collins, Colorado, and the Air Force Engineering and Services Center at Tyndall AFB, Florida, found at http//www.nonoise.org/library/animals/litsyn.htm.)

The National Park Service also published a lengthy report to Congress in the fall of 1994, "The Report on Effects of Aircraft Overflights on the National Park System." The report was quick to acknowledge that more research is necessary to determine fully the impact of aircraft on park animals. "However, waiting for and relying on future research results for current policy decisions is not possible," said the report, underscoring the need for action to protect wildlife. After more than six years, a plan to write guidelines governing the occurrence of aircraft overflights is in place -- the National Parks Air Tour Management Act of 2000 -- but guidelines and regulations have not yet been adopted as of March, 2001.

"When disturbed by overflights, animal responses range from mild `annoyance,' demonstrated by slight changes in body position, to more severe reactions, such as panic and escape behavior," the National Park Service said. "The more severe reactions are more likely to have damaging consequences." The report cited studies showing that exposure to low-altitude AGL flights does produce stress in species such as pronghorn, elk and bighorn sheep, as indicated by racing heart rates. Stress induced by other disturbances is known to have long-term, deleterious effect on the metabolism and hormone balance of some ungulates, it said, warning in addition that the effects of stress may be magnified if occurring at difficult times such as during a water shortage. Another danger raised in the National Park Service report is that animals sometimes fall, run into objects, or become trampled when they panic and run from aircraft. In difficult terrain studded with boulders or marked by cliffs and canyons, a stumble can be fatal. The report also warned of potential reproductive losses, citing the separation of mothers from young during a flight response. The vulnerable young are exposed to predators. With birds, the eggs or even babies may be kicked out of the nest. It also raised the possibility of a mother's milk supply being interrupted or drying up under stress. (For a copy of the National Park Service report, see http://www.nonoise.org/library/npreport/intro.htm.)

The report cautioned that a special danger is posed to threatened or endangered species, which often have achieved their special status due to habitat loss from development and general human encroachment. Their natural histories prevent them from using any but specific habitat types. It is important that overflights not cause further habitat loss to these species, since they cannot simply "relocate," the National Park Service said. Species in Teton County that have been or are now considered threatened or endangered include the bald eagle, lynx, grizzly bear and trumpeter swan.

## …SOME FINDINGS OF THE NATIONAL PARK SERVICE

Following are findings carried in the National Park Service report to Congress in 1994, gathered from earlier scientific surveys, reports of other government agencies and from National Park Service research.

- Excessive stimulation of the nervous system can amount to chronic stress, and continuous exposure to aircraft overflights can be harmful for the health, growth and reproductive fitness of animals.

- Panic reactions and escape responses to overflights can be energetically "expensive" to animals for two reasons. First, feeding animals nearly always stop eating when disturbed, thus decreasing their energy intake. Second, disturbed animals often run away from the aircraft, increasing their energy expenditure. Running can increase an ungulate's metabolism twenty-fold over the normal resting rate. Frequent disturbance of the energy and nutrient supply for animals can compromise growth and reproduction.

- Birds may suffer from energy losses due to chronic disturbance, especially during periods when increasing and storing energy reserves is critical for survival. Birds need to store energy in advance of migration or to get through breeding season and raise their young. If birds must "continuously swim, dive, or run from aircraft," they may not retain sufficient energy to meet these life needs.

- Helicopters apparently disturb some animals more than other types of aircraft. For example, caribou ran longer and farther in response to helicopter overflights than they did in response to low-altitude AGL overflights by military jets during a study in the Yukon. Helicopters that appear by surprise -- for example rising suddenly over the top of a cliff -- have provoked extreme responses in some wildlife that do not panic when aircraft can be observed approaching from a distance.

- "One relationship between aircraft and animals is clear: the closer the aircraft, the greater the probability that an animal will respond, and the greater the response," the report said. But there is no particular overflight altitude AGL at which all animals are or are not disturbed. Researchers have reported disturbances to walruses by helicopters flying as far away as 4,270 feet. Grizzly bears run away from aircraft flying at altitudes as high as 3,000 feet AGL. Many animals are disturbed at much

lower altitudes AGL. Studies of bighorn sheep showed that when helicopters passed at 1,640 to 4,920 feet AGL, there was no response. At the lower flying level of 490 to 650 feet AGL, the sheep had accelerated heart rate, and with helicopters at altitudes of 160 to 650 feet AGL the bighorns left the area.

A test cited in the FAA 1985 report on noise had similar findings. At Aransas National Wildlife Refuge in Texas, 11 bird species were put to the test. The reactions of six species increased as did the level of noise. The grebes' response increased only slightly, but the ring-necked ducks, coots, gadwalls, purple gallinules and pintail ducks reacted more strongly as the helicopter noise level went up. The Canadian goose and snow goose didn't alter reactions -- they did not "tolerate" noise at any level, according to the FAA. (FAA study may be found at http://www.nonoise.org/library/ane/ane.htm.)

Table 8 below summarizes scientific studies cited in the National Park Service report that involve helicopter overflights. The table includes all studies on species in which the effects of helicopter overflights at varying altitudes AGL have been recorded.

**Table 8**

**STUDIES OF WILD ANIMAL RESPONSES TO HELICOPTER OVERFLIGHTS**

| Species | Altitude (AGL) in feet | Author |
|---|---|---|
| **PRONGHORN ANTELOPE** | | |
| Bolt and run | 100 | Workman et. al. 1992a |
| Stop feeding, tense muscles | 150-400 | Luz & Smith 1976 |
| Run | 150-400 | Luz & Smith 1976 |
| No response | 150-400 | Luz & Smith 1976 |
| **BIGHORN SHEEP** | | |
| Accelerated heart rate | 100 | Workman et. Al. 1992b |
| Leave area | 160-650 | Bleich et. al. 1990 |
| Accelerated heart rate | 490-660 | MacArthur et. al. 1979 |
| No response | 1,640-4,920 | MacArthur et. al. 1979 |
| **GRIZZLY BEAR** | | |
| Run toward cover | 200-500 | Klein 1973 |
| "Mild" behavior response | over 3,280 | Ruttan 1974 |

Source: 1994 National Park Service report to Congress, Chapter 5, "Effects of Overflights on Wildlife," available at http://www.nonoise.org/library/npreport/chapter5.htm.

## ANOTHER BAD MIX: PARKS, WILDERNESS, NOISE AND PEOPLE

In a definitive 1985 study on aviation noise, the FAA pointed to some of the reasons human animals get so disturbed when a low-flying aircraft buzzes over them in a quiet environment: "The type of neighborhood may actually be associated with one's expectations regarding noise there. People expect rural neighborhoods to be quieter than cities. Consequently, a given noise exposure may produce greater negative reaction in a rural area." The same FAA report suggested that the source of noise also correlates to the degree of irritation it invokes. "If the noise is produced by an activity which people feel is vital, they are not as bothered by it as they would be if the noise-producing activity was considered superfluous." It would be reasonable to assume from the FAA document that the hum of cars on a city freeway would be much easier to accept than the drone carried into wilderness by a touring helicopter with a handful of tourists. (For excerpts of the FAA noise study and an explanation of how sound and noise are measured, see Appendix 9 on page 49 and Appendix 10 on page 50.)

The eloquent introduction to a 1994 National Park Service report on the impact of aircraft overflights helps to explain those responses: "So it is that we might almost say silence is the tribute we pay to holiness; we slip off words when we enter a sacred space, just as we slip off shoes. A `moment of silence' is the highest honor we can pay someone; it is the point at which the mind stops and something else takes over (words run out when feelings rush in). A `vow of silence' is for holy men the highest devotional act. We hold our breath, we hold our words; we suspend our chattering selves and let ourselves `fall silent,' and fall into the highest place of all." For many people, especially in today's nagging cacophony of motors, horns, ringing phones, radios and even talking elevators, tuning out in a park or wilderness area is grasped as a rare chance to indulge in the quiet of the natural world. The National Park Service adroitly observed: "The greatest charm of noise is when it ceases."

National Park Service policy holds "natural quiet" to be a resource that the Service is mandated to protect and preserve. A 1988 policy statement is among several that specify this responsibility: "Activities causing excessive or unnecessary unnatural sounds in and adjacent to parks, including low-altitude AGL aircraft overflights, will be monitored, and action will be taken to prevent or minimize unnatural sounds that adversely affect park resources or values or visitors' enjoyment of them." The 1994 study and survey showed that most park managers judge that aircraft overflights interfere with the opportunity for visitors to enjoy natural quiet. By measuring ambient sound levels, the National Park Service found variations from park to park, and from place to place within parks. But overall, the study determined that quiet in park settings "is virtually in a range of its own, well below that which we experience in our normal daily routine."

Table 9 on page 28 provides a preview of the sound of scenic helicopter in the backcountry if Vortex Aviation or another scenic tour operator brings the promised Aerospatiale 350 Series helicopter to Wyoming.

**TABLE 9**

**HOW MUCH NOISE TO EXPECT FROM WYOMING SCENIC HELICOPTER TOURS**

| | Effective Perceived Noise Level (EPNL) in Decibels (dB) | A-weighted Sound Level in Decibels (dB) |
|---|---|---|
| Sitting 390 feet under Aerospatiale 350 Series helicopter (descending at 6 degree angle at 63 MPH) | 94.1 | 82.9 |
| Sitting 500 feet under Aerospatiale 350 Series helicopter (level overflight, airspeed varying from 86 to 143 MPH) | 86.1 | 75.2 |
| Sitting under an Aerospatiale 350 Series helicopter (level flight at 1,000 feet at 130 MPH) | 82.4 | 69.9 |

Source: Federal Aviation Administration, Office of Environment and Energy, "Noise Measurement Test Flight: Data/Analysis Aerospatiale AS 350D AStar Helicopter" (Washington, D.C.: September 1984). Available from National Technical Information Service, U.S. Department of Commerce. For technical descriptions of various ways of measuring sound and noise, see Appendix 10 on page 50.

## WHY NOISE IS MORE INTRUSIVE IN THE BACKCOUNTRY

Scientific studies have found that the quieter the natural surroundings, the louder a helicopter sounds. Except during high winds and thunderstorms, the Wyoming backcountry is so quiet that even a distant scenic tour helicopter would sound noisy.

As part of its study, the National Park Service traced ambient sound levels in several park or refuge areas, including during aircraft overflights. The National Park Service found:

- Great Meadows National Wildlife Refuge, about 25 miles northwest of Boston, Massachusetts, was a relatively noisy ambient environment. During a test, the "background" sound measured 45 to 50 decibels, caused by wind blowing through deciduous woods and distant road traffic. During four overflights by single-engine propeller aircraft, the total sound increased to 20 to 25 decibels above the ambient level. The airplanes were "clearly audible," even against the relatively noisy environment of Great Meadows. (The National Park Service report used "A-weighted decibels" to measure sound. For an explanation of how sound and noise are measured, see Appendix 10 on page 50.)

- At Hawaii's Haleakala National Park, the trace showed an extremely quiet natural environment, with ambient sound levels ranging from 7 to 27 decibels. When a "distant" helicopter air tour flew in the vicinity of the sound measuring equipment, the sound trace showed an increase of 20 decibels. Again, the helicopter was "clearly audible."

- The National Park Service reported that if a "distant" helicopter emitting the same amount of sound as the one near Haleakala had flown in the vicinity of Great Meadows refuge where there is more background noise, that helicopter's sound would have been "completely inaudible in that ambient environment."

This is how the phenomenon was explained in the 1988 report by the Air Force and Fish and Wildlife Service: "When one noise is much greater than another, the addition of the lesser noise typically adds an almost undetectable amount to the overall decibel level. For example, the addition of one F-15 taking off with a B-52 would not likely increase the detectable sound pressure level generated by the one operating alone."

The park, wilderness and refuge areas of Teton County are far removed from the heavy traffic and other city sounds that waft over Great Meadows. Because the background environment is so silent, it is inevitable that scenic tour helicopters would be annoyingly audible even at great distances. The National Park Service concluded regarding aircraft overflights: "Extremely low ambient sound levels in many parks means that visitors to remote sections of those parks are likely to hear aircraft, even if aircraft sound levels are very low."

More than four million visitors come to Jackson Hole to visit Grand Teton National Park and other attractions every year. Most of them come to experience the park, the national forest and wilderness or the refuge areas that comprise 97 percent of the county. They expect to leave behind the annoying trappings of modern life, not be followed by them into the wilds.

## THE EFFECTS ON HISTORIC PLACES HAVE NOT BEEN STUDIED

The National Register of Historic Places lists 40 national historic sites in Teton County, and at least a dozen more sites in Teton County may be eligible for listing under the National Historic Preservation Act of 1969. At least two of the officially listed historic sites -- the Miller Cabin in the National Elk Refuge north of Jackson and the Gap Puche Cabin east of Kelly -- are under or close to the flight path of the proposed Vortex Aviation scenic helicopter tours. Three others in the town of Jackson -- St. John's Episcopal Church, the Van Vleck House and the Wort Hotel -- may be close to the proposed Vortex Aviation flight path. As far as is known, neither the FAA nor any other agency has studied the potential adverse effects of helicopter tours on historic sites and potential historic sites in Teton County. Nor has the U.S. Advisory Council on Historic Preservation been asked by the FAA to comment on the potential effects on historic sites resulting from FAA approval of scenic helicopter tour flights from the Jackson Hole Airport, as may be required under a regulation under the National Historic Preservation Act known as 36 CFR 800.

# Part Three

# ECONOMIC RISKS AND REWARDS OF ACTION TO LIMIT WYOMING HELI-TOURS

As a matter of economic necessity, Wyoming must rely on its reputation for enabling visitors to experience the tranquility of nature and the majestic beauty of the mountains. The introduction of scenic helicopter tours will put all of this at risk in Teton County.

Of the more than 900 businesses that are members of the Jackson Hole Chamber of Commerce, at least 250 depend directly on revenues from the more than three million people who visit Teton County every year. These range from gas stations to guest ranches, from boutiques to bed-and-breakfasts. Except for the owner of a local taxicab company, not one of these roughly 250 tourist-dependent businesses is known to have gone on record in support of scenic helicopter tours in Teton County. On the other side, more than 6,000 people have signed petitions against scenic helicopter tours in Teton County. Some local businesses have expressed strong opposition to scenic helicopter tours. These include a group of seven guest ranches that in 2000 hired a lawyer to oppose scenic tours. Early in 2001, the Jackson Hole Chamber of Commerce declared its support for Senator Craig Thomas's bill that would ban scenic air tours over Grand Teton and Yellowstone National Park.

The preponderance of opinion against scenic helicopter tours is so strong in Teton County that the long-time fixed base operator at the Jackson Hole Airport declined to sign a subcontract with Vortex Aviation for scenic helicopter tour operations. This required the Jackson Hole Airport Board to take the unusual step of signing a direct contract with Vortex Aviation under a mandate from the FAA.

To the extent that scenic helicopter tours interfere with visitors' tranquil experiences in Jackson Hole, the overall economic impact on all Teton County businesses is bound to be negative. If scenic heli-tours get established in Teton County, then mountain resort towns elsewhere in the West whose reputations are not being harmed by the annoying noise of helicopter tours will profit at the expense of existing Jackson Hole businesses. Those towns that stand to profit from heli-tours in Teton County include Aspen and Vail in Colorado and Big Sky in Montana.

There are no helicopter or fixed-wing scenic air tour operations in Teton County. So there will be no impact on any existing tour operators if Congress bans heli-tours over, in and out of Grand Teton and Yellowstone National Parks. Nor will there be any impact if the FAA adopts a SFAR requiring stringent safety precautions and altitude AGL limits for scenic helicopter flights over national wildlife refuges and national wilderness areas.

The entity that stands to be the most affected economically is Vortex Aviation, whose managing member Mr. Gary Kauffman indicated in a February 2001 interview with the Jackson Hole News that Vortex Aviation plans to begin scenic helicopter tours in Teton County in the summer of 2001.

Vortex Aviation has argued in litigation against the Jackson Hole Airport Board that it was hurt economically when the Airport Board in July 2000 declared a moratorium on scenic tour flights from the Jackson Hole Airport. However, that moratorium was ended in October 2000 under orders of the FAA.

Judging from public evidence, there should be relatively little additional economic impact on Vortex Aviation if Congress bans commercial scenic tour operations in the national parks or if the FAA issues the proposed SFAR. Here are some reasons for believing as of early May 2001 that the additional impact on Vortex Aviation would be quite limited:

- Vortex Aviation was not known to have hired any staff in Teton County.

- Vortex Helicopters had put up for sale the Aerospatiale 350 Series helicopter that Vortex Aviation has told the Jackson Hole Airport Board it intends to use for Teton County scenic helicopter tours. (Source: see the Vortex Helicopters website, www.vortexhelicopters.com.)

- During the six months after the FAA's October 2000 order clearing the way for Vortex Aviation to fly scenic helicopter tours in Teton County, the company did not base a helicopter or start an office in Teton County. Vortex Aviation had set up a PO Box and phone number in Jackson that was answered by a recording. The recording made no mention of heli-tours.

- Vortex Aviation had apparently not made the major financial commitment necessary to market scenic tours successfully in the face of a determined local opposition. Vortex Aviation had obtained the services of an Arizona-based marketing official who made one trip to Jackson Hole on behalf of the company. However, Vortex Aviation had not run any advertisements or set up a website to promote scenic tours.

- The managing member of Vortex Aviation sent a letter to one of the authors of this report offering to "consider forgoing our rights to operate scenic helicopter tours in the Jackson area" if the author agreed to "coordinate a coalition that would fund Vortex to set up EMS services for the Yellowstone-Teton corridor." However, no one in Jackson Hole agreed to raise money to help Vortex Aviation start the proposed helicopter EMS business in exchange for a possible withdrawal from offering scenic helicopter tours. (For the text of the Vortex Aviation letter, see Appendix 12 on page 52.)

In the summer of 2000, Vortex Aviation informed the Jackson Hole Airport Board that it would fly at least 2,000 feet above the National Elk Refuge in order to protect wildlife. The proposed SFAR would require Vortex Aviation and any other scenic tour operators to conduct their entire scenic tours at a suitable minimum altitude AGL (except for takeoffs and landings). This might well require Vortex Aviation or another scenic tour operator to buy more aviation fuel to fly at higher altitudes. Whatever these extra costs in aviation fuel might be, they would likely be outweighed by the extra safety benefits the tour operator and its passengers would derive from lessening the risk of an accident.

The prospective air tour operator's revenues might also be affected by the proposed temporary ban on scenic helicopter flights in Teton County. However, this economic impact would be small compared to the economic benefits to other Teton County businesses and to the increased peace of mind that would accrue to residents and visitors of Teton County.

# Part Four

# CONCLUSIONS: WHAT SHOULD BE DONE

Heli-tours should be banned in Teton County for the compelling environmental, economic and safety reasons set forth in this report. The best chance to begin this process is for a broad coalition of citizens to support congressional legislation under the leadership of Senator Craig Thomas, chairman of the Senate National Parks Subcommittee, aimed at banning scenic air tours over Grand Teton and Yellowstone National Parks.

By banning air tours over Grand Teton and Yellowstone National Parks, Congress would guarantee Grand Teton and Yellowstone the same level of protection that Congress and the FAA have granted to Rocky Mountain National Park in Colorado. When the FAA first imposed a temporary ban on air tours over Rocky Mountain National Park in 1997, there were no air tour companies in operation there, but several companies were making preparations to begin scenic tours. (For an excerpt of the FAA's special rules for Rocky Mountain National Park, see Appendix 7 on page 46.) The FAA temporary ban on scenic air tours over Rocky Mountain National Park was made permanent by Congress under Section 806 of the National Parks Air Tour Management Act of 2000. Now Grand Teton and Yellowstone are at a similarly sensitive crossroads because scenic heli-tours are due to begin in Teton County in June 2001. This means Congress should act swiftly to enact Senator Thomas's legislation in the strongest possible form.

Senator Thomas's bill would be an important milestone on the path toward full protection of residents, visitors and wildlife against scenic heli-tours in Teton County. But it is unrealistic to put the whole burden on Congress for achieving what is needed. In addition to congressional action, the FAA should act urgently on its own by imposing a temporary ban on all scenic helicopter tour flights in Teton County in order to conduct urgent rulemaking. The object should be the adoption of a Special Federal Aviation Regulation (SFAR) designed to achieve the following:

1) In light of the 460% increase in injuries and deaths from U.S. scenic helicopter tours since five years ago, the FAA should require a suitable minimum altitude AGL for all commercial scenic tours over Teton County and other Wyoming counties seeking this protection. The FAA deserves the public's commendation for bringing about a sharp reduction in scenic helicopter tour accidents in Hawaii by ordering a 1,500-foot minimum altitude AGL for scenic air tours in that state. Teton County deserves no less protection, and FAA rulemaking may well support the conclusion that its extraordinarily challenging high-altitude back country terrain may warrant an even greater margin of safety. As in Hawaii, the main purpose would be to allow sufficient time for a pilot to select a safe landing place and prepare the aircraft and passengers for an emergency landing. (For an excerpt of the FAA's special rules for Hawaii, see Appendix 6 on page 45.)

2) In light of the need to protect wildlife and human visitors in five of the most sensitive and biologically rich stretches of federal wildlife habitat in Wyoming, the FAA should order a suitable minimum altitude AGL for all commercial scenic air tours over the National Elk Refuge, the Gros Ventre National Wilderness Area, the Jedediah Smith Wilderness Area, the Teton Wilderness Area and the Winegar Hole Wilderness Area. These five large tracts of public land are critical habitat for the bald eagle, trumpeter swan, bison, bighorn sheep, grizzly bear and lynx, which are either on the lists of endangered or threatened species or are important symbols of America's national heritage. Recognizing that excessive aircraft noise "can adversely affect wildlife," the FAA issued an advisory circular during the Reagan Administration suggesting that pilots maintain a minimum altitude of 2,000 feet AGL above "noise-sensitive" areas including national wildlife refuges and national wilderness areas. But the U.S. Fish and Wildlife Service has found that the voluntary FAA altitude limit is often disregarded over wildlife refuges. (For the definition of the 2,000-foot AGL altitude limit, see FAA Advisory Circular 91-36 and accompanying "Note" in Appendix 8 on page 47.)

3) U. S. scenic helicopter tour companies are set up for no other purpose than to carry passengers commercially. Their operations have been characterized by a 460% increase in deaths and injuries since five years ago. And the Wyoming high-elevation backcountry terrain poses extra challenges for aviators. In light of these facts, the FAA should require a set of special safety precautions for helicopter scenic tours on high-altitude MSL routes in Teton County and other Wyoming counties requesting such protection. The SFAR should require scenic helicopter tour operators:

a) to operate as Wyoming-based companies so they would be subject to the inspection and oversight of the FAA's Denver Flight Standards District Office and the Casper Flight Standards Field Office. Those offices are better suited to protect the flying public in Teton County because they are more familiar with the unique challenges of flying in high mountainous terrain than are most FAA flight standards district offices elsewhere in the country.

b) to use helicopters that meet specifications for "hot and high" use, including increased power and payload capacity over a broader temperature/altitude envelope than would be necessary at lower altitudes MSL.

c) to keep at least one responsible manager or mechanic on duty near the helicopter base to monitor whether each scenic tour flight returns on schedule. It would be part of that employee's responsibility to set into motion a timely rescue effort if a helicopter tour flight is overdue returning to the airport.[1]

d) to require that all scenic tour helicopters carry a functioning Emergency Location Transmitter (ELT) on all flights.

e) to require that all scenic tour helicopters are equipped with hand-held FM radio transmitters, in line with corrective action taken in 1999 by Alaska's Temsco Helicopters during a 1999 NTSB accident investigation.

f) to equip scenic tour helicopters with radar altimeters or FAA-approved ground proximity warning systems such as the TAWS system.[2]

g) to fill out a written "performance plan" before each flight patterned on the "performance plan" required of Hawaii scenic air tour operators. Under this plan, tour operators would have to calculate the maximum weight a helicopter can safely carry, taking into account the expected altitude MSL, temperature and humidity. Tour operators would be required to restrict the takeoff weight enough to allow the pilot to safely perform a high-altitude MSL "autorotation" landing if necessary.

h) to provide scenic tour passengers prior to takeoff with briefings on how to prepare for an emergency landing and safely exit the helicopter. The briefing should be comparable to the briefings on "water ditching procedures" that the FAA has mandated for helicopter scenic tours in Hawaii.

i) to require that each scenic helicopter tour pilot has flown helicopters a minimum of 1,000 hours over-high elevation mountainous terrain and has undergone FAA-approved survival training.

j) to require that their helicopters carry enough water, military-type rations, sleeping bags, first-aid gear, trail maps, compasses, GPS locators, matches and bear repellant spray to allow the pilot and all passengers to live safely in the wilderness for at least one day while awaiting rescue.

k) to equip their helicopters with cockpit voice and data recorders in order to reduce the number of scenic helicopter tour accidents with undetermined causes.

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[1] In his March 2001 response to a draft of this report, the Vortex Aviation managing member said that "a flight following procedure is in place for every charter and scenic tour flight."

[2] The TAWS system is proposed here in part to meet the objections of the prospective Teton County scenic tour operator to an earlier proposal to install radar altimeters to avoid crashes in fog. In his March 2001 response to a draft of this report, the Vortex Aviation managing member wrote: "Your recommendation that we install a radar altimeter shows me that your research is incomplete and you know very little about our type of operations."

# APPENDICES

## APPENDIX 1

### *U.S. SCENIC TOUR HELICOPTER ACCIDENTS (OCTOBER 1, 1988-MARCH 31, 1995)*

**(AS DESCRIBED IN APPENDIX A OF THE NTSB'S "SPECIAL INVESTIGATION REPORT: SAFETY OF THE AIR TOUR INDUSTRY IN THE UNITED STATES," APPROVED BY NTSB ON JUNE 1, 1995*)***

| Date | Place | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| **1988** | | | | | | |
| 12/12/88 | Hanalei, HI | Partial loss of power | 5 | 0 | 0 | Hughes 369E |
| **1989** | | | | | | |
| 5/20/89 | Waialea Falls, HI | Partial loss of power | 7 | 7 | 0 | Aerospatiale AS-350D |
| 7/24/89 | Kalapana, HI | Total loss of power | 3 | 1 | 0 | Hughes 269D |
| 8/19/89 | Volcano, HI | Partial loss of power | 7 | 6 | 0 | Aerospatiale AS-350D |
| 5/30/89 | Niagara Falls, NY | In-flight collision with object | 4 | 0 | 0 | Hughes 369HS |
| 6/17/89 | Lockport, IL | In-flight collision with object during takeoff | 3 | 3 | 0 | Hughes 269C |
| 8/14/89 | Wisconsin Dell, WI | Hard landing | 3 | 3 | 0 | Bell 47G-2A-1 |
| 9/8/89 | Boston, MA | Loss of control in flight during hover | 3 | 0 | 0 | Enstrom F-28 |
| 12/8/89 | Waimea, HI | Partial loss of engine power during cruise flight | 5 | 0 | 0 | Hughes 369HS |

| Date | Place | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| **1990** | | | | | | |
| 3/3/90 | Miami, FL | Total loss of engine power during cruise flight | 3 | 2 | 0 | Bell 47G |
| 3/25/90 | Rockledge, FL | Total loss of engine power during cruise flight | 3 | 0 | 0 | Bell 47D1 |
| 5/13/90 | Marathon, FL | Airframe/component/system failure during takeoff | 3 | 0 | 0 | Enstrom F-28A |
| 5/23/90 | Griffin, FL | Loss of control in flight | 2 | 1 | 1 | Robinson R22B |
| 6/15/90 | Cedar Rapids, IA | Loss of control in flight during maneuvering | 3 | 0 | 3 | Bell 47G3B1 |
| 6/21/90 | Randle, WA | In-flight collision with object | 4 | 0 | 0 | Hughes 369HS |
| 6/23/90 | Hanapepe, HI | In-flight collision between two scenic tour helicopters | 10 | 0 | 0 | two Hughes 369Ds |
| 6/30/90 | Glacier, WA | Passenger hit by rotor | 5 | 0 | 1 | Aerospatiale AS-350B |
| 7/13/90 | Toutle, HI | Forced landing during maneuvering | 5 | 2 | 0 | Hughes 369D |
| 8/17/90 | Juneau, AK | Total loss of engine power | 6 | 0 | 0 | Aerospatiale AS-350B |
| 11/1/90 | Gatlinburg, TN | In-flight collision with object during landing | 3 | 3 | 0 | Bell 47J-2 |
| 12/18/90 | Keanae, HI | Partial loss of power | 4 | 0 | 0 | MD 369D |
| **1991** | | | | | | |
| 5/5/91 | Keanae, HI | Loss of power | 5 | 3 | 0 | Hughes 369HS |
| 6/6/91 | Lihue, HI | Total loss of power | 4 | 4 | 0 | Bell 206B |
| 7/22/91 | Toutle, WA | Loss of control in flight while maneuvering | 5 | 3 | 1 | Bell 206B |
| 7/24/91 | Kahului, HI | Total loss of power (non-mechanical) | 6 | 0 | 0 | Aerospatiale AS-350B |
| 9/15/91 | Penuelas, PR | Loss of control during takeoff | 3 | 0 | 0 | Bell 47G-3B1 |
| 10/12/91 | Catawissa, PA | Loss of control in flight | 4 | 4 | 0 | Bell 47G-3B1 |

| Date | Place | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 10/14/91 | Hilo, HI | Loss of power during hover | 7 | 0 | 0 | Aerospatiale AS-350D |
| 11/9/91 | Hilo, HI | Hard landing in adverse weather | 4 | 3 | 0 | Bell 206B |
| **1992** | | | | | | |
| 4/11/92 | Mount Vernon, WA | In-flight encounter with weather during landing | 2 | 0 | 0 | Enstrom 280FX |
| 5/30/92 | Volcano, HI | Airframe/component/system failure | 5 | 0 | 0 | MD 369D |
| 6/19/92 | Waikoloa, HI | Main gear collapsed | 7 | 7 | 0 | Bell 206L3 |
| 9/16/92 | Hana, HI | In-flight encounter with weather | 7 | 0 | 7 | Aerospatiale AS-350B |
| 9/21/92 | Volcano, HI | Loss of control in flight while hovering | 3 | 3 | 0 | Bell 47-G4A |
| 9/29/92 | Niagara Falls, Canada/NY | Midair collision between 2 scenic tour helicopters | 9 | 1 | 4 | Bell 206-B and MD 500E |
| 12/4/92 | Kamuela, HI | Total loss of power due to mechanical failure or malfunction | 4 | 1 | 0 | Hughes 369C |
| 12/7/92 | Kahului, HI | Loss of control | 2 | 0 | 0 | Hughes 269B |
| 12/21/92 | Hilo, Hawaii | Loss of engine power | 5 | 5 | 0 | Hughes 369B |
| **1993** | | | | | | |
| 1/25/93 | Volcano, HI | Loss of control in flight | 5 | 1 | 4 | Fairchild Hiller FH-1100 |
| 6/15/93 | Orlando, FL | Unsuitable terrain for forced landing (*) | 3 | 2 | 0 | Hughes 369HS |
| 6/19/93 | Panama City, FL | Pilot error during takeoff (*) | 3 | 3 | 0 | Bell 47G |
| 8/7/93 | Tuscayan, AZ | In-flight collision near Grand Canyon between 2 scenic tour helicopters | 14 | 12 | 0 | Bell 206L1 and Bell 206L3 |
| 8/22/93 | Auburn, WA | Partial loss of engine power during takeoff | 3 | 0 | 0 | Hiller UH-12E |

| Date | Place | What Happened | Aboard | Injured | Killed | type |
|---|---|---|---|---|---|---|
| 9/10/93 | Ogden, UT | In-flight collision with water | 5 | 4 | 1 | Aerospatiale AS-365N2 |
| 10/29/93 | New York, NY | Total loss of engine power during normal cruise flight | 6 | 0 | 0 | Bell 206L |
| **1994** | | | | | | |
| 2/23/94 | Humuula, HI | In-flight collision with terrain | 7 | 2 | 0 | Aerospatiale AS-350B |
| 2/28/94 | Huelo, HI | Partial loss of engine power during landing | 5 | 0 | 0 | Aerospatiale AS-350D |
| 3/25/94 | Hawaii National Park, HI | Loss of control during hover | 2 | 2 | 0 | Hughes 369D |
| 3/25/94 | Orlando, FL | Loss of engine power during takeoff | 7 | 7 | 0 | Bell 206L |
| 4/18/94 | Hanapepe, HI | Loss of engine power during takeoff | 5 | 4 | 1 | Hughes 369D |
| 4/22/94 | Marathon, FL | Airframe/component/system failure during cruise flight | 3 | 1 | 2 | Bell 47D1 |
| 5/7/94 | Crystal Beach, TX | Loss of engine power during takeoff | 3 | 0 | 0 | Hiller UH-12B |
| 7/14/94 | Hanalei, HI | Loss of power due to mechanical problem led to ditching in water | 7 | 0 | 3 | Aerospatiale AS-350B |
| 7/14/94 | Kapailoa, HI | Loss of power led to ditching in water | 7 | 1 | 0 | Aerospatiale AS-350B |
| 7/19/94 | Juneau, AK | In-flight collision with terrain/water | 7 | 0 | 0 | Aerospatiale AS-350 |
| 7/24/94 | Seaside, OR | Inflight collision with terrain/water | 2 | 0 | 2 | Hughes 369HS |
| 8/11/94 | KuKuihaele, HI | Loss of power and collision with terrain | 7 | 0 | 0 | Aerospatiale AS-350D |
| 9/4/94 | Kilauea Crater, HI | Dynamic roll-over | 5 | 0 | 0 | Hughes 500E |

| Date | Place | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 10/24/94 | Kaupo, HI | Loss of engine power | 4 | 0 | 0 | Aerospatiale AS-350D |
| **1995** | | | | | | |
| 3/18/95 | San Gorgonio, CA | Loss of control | 3 | 0 | 0 | Enstrom F28-C |
| 3/25/95 | Burnet, TX | Loss of power | 3 | 0 | 0 | Hughes 369HS |

Source: NTSB, "Safety of the Air Tour Industry in the United States" (NTSB Document Number PB95917004, adopted by the board 6/1/95). This is not available on the internet but can be purchased from NTIS. This appendix includes 61 of the 62 accidents described in the NTSB report. The 62d accident, in which five people died in Barbados, was omitted from this report because it did not occur in the United States**.**

**(*)** The NTSB determined the probable cause of these accidents after issuance of NTSB report on June 1, 1995. The probable cause shown in this appendix was taken by the authors from subsequently-published final NTSB reports on these accidents.

# APPENDIX 2

## *U.S. SCENIC TOUR HELICOPTER ACCIDENTS (APRIL 1, 1995 - MARCH 31, 2001)*

**(AS DESCRIBED IN PRELIMINARY AND FINAL NTSB ACCIDENT REPORTS IN NTSB DATABASE, INCLUDING NTSB'S FINDING OF "PROBABLE CAUSE" WHERE AVAILABLE)**

| Date | Place | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| **1995** | | | | | | |
| 5/31/95 | Skagway AK | While preparing to take off from Ferebee Glacier, helicopter slid into a crevasse and rolled onto its side - cause: pilot's choice of unsuitable terrain | 7 | 0 | 0 | Aerospatiale AS-350B2 |
| 10/11/95 | Hana, HI | Pilot experienced loss of engine power during takeoff and damaged helicopter during emergency landing - cause: inadequate maintenance | 5 | 4 | 0 | Hughes 369HS |
| **1996** | | | | | | |
| 7/11/96 | Pigeon Forge, TN | Air tube separated from engine governor during a heli-tour of Great Smoky Mountains National Park. Pilot made an emergency landing after sudden power loss - cause: "fatigue cracking" inside engine due to improper installation of the air tube | 5 | 5 | 0 | Bell 206B |
| 11/12/96 | Hana, HI | Pilot heard a “loud explosion” from engine compartment; helicopter rolled over after emergency landing - cause: cracked gear shaft | 5 | 0 | 0 | McDonnell Douglas 369D |
| **1997** | | | | | | |
| 12/31/97 | New York City, NY | In a strong, gusty wind, helicopter collided with control room building at helipad returning from a sightseeing tour - cause: pilot misjudgment | 6 | 4 | 0 | Aerospatiale 355 |
| **1998** | | | | | | |
| 2/3/98 | Watson Island, FL | Pilot encountered gust of wind while trying to hover - helicopter rolled over on its side - cause: loss of power for undetermined reasons | 3 | 0 | 0 | Bell 206B |

| Date | Where | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 5/9/98 | Fort Walton Beach, FL | Engine failed while helicopter at 500-600 feet AGL over Gulf of Mexico - helicopter emergency landing into 4-5 feet of water - cause: undetermined engine failure | 3 | 3 | 0 | Bell 47-G2 |
| 5/30/98 | Juneau, AK | Helicopter bound for the glaciers collided in midair with Cessna 172 prop plane - cause: insufficient attention by both pilots | 8 (3 on plane - 5 on helicopter) | 1 | 2 | Aerospatiale AS-350B2 |
| 6/25/98 | Mount Waialeale, HI | Helicopter crashed into an 80-85 degree slope near crest of a 2,300-foot MSL volcano - wreckage inaccessible from ground - cause: undetermined | 6 | 0 | 6 | Aerospatiale AS-350-BA |
| 8/4/98 | Bryce Canyon, UT | Engine failed and helicopter was damaged during attempt to make a "high altitude run" on landing - cause: turbocharger oil leak | 3 | 0 | 0 | Enstrom 28-F |
| 8/12/98 | Marco Island, FL | Helicopter experienced total loss of power and crash-landed near a dirt road, turning on its belly - cause: pilot ran out of fuel | 3 | 0 | 0 | Enstrom F-28 |
| **1999** | | | | | | |
| 2/1/99 | Grand Canyon, AZ | Helicopter's left-side bubble window blew out and collided with tail rotor blade during flight - pilot landed safely in canyon - cause undetermined - classified by NTSB as an "incident" | 7 | 0 | 0 | Aerospatiale AS-350-B |
| 4/1/99 | Grand Canyon, AZ | Engine stopped during an orientation flight for a newly-hired scenic tour pilot - cause: snow blew into engine inlets | 2 | 1 | 1 | Bell 206B |
| 6/9/99 | Juneau, AK | Helicopter crashed into glacier - cause: novice pilot's "spatial disorientation" in bad weather; the pilot had complained of "company pressure to fly in bad weather" and had only 37.5 hours experience of flying turbine helicopters - this was his second day of flying passengers by himself in this kind of helicopter | 7 | 0 | 7 | AS-350BA |
| 6/11/99 | Sevierville, TN | Flying at 500 feet AGL to Great Smoky Mountains National Park, pilot heard a noise "similar to a shotgun blast" and helicopter began to shake - pilot crash-landed into a tobacco field - cause: metal "fatigue fracture" in rotor drive | 3 | 0 | 0 | Robinson R-44 |
| 6/20/99 | Telluride CO | Pilot of proposed scenic tour operation allowed helicopter to go into spin, resulting in crash landing - cause: pilot error, high altitude MSL, warm air | 4 | 4 | 0 | Bell-206B |
| 8/10/99 | Custer State Park, SD | Pilot collided with tree and rocks while maneuvering for a better camera view of Mount Rushmore - cause: pilot flew too close to mountain | 5 | 3 | 2 | Bell 206B |

| Date | Where | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 9/10/99 | Juneau, AK | Pilot crashed into ice field during “whiteout conditions” - cause: pilot flew in instrument weather while not instrument-rated | 6 | 6 | 0 | Aerospatiale AS-350-B2 |
| 9/10/99 | Juneau, AK | A second helicopter from same scenic tour company crashed into ice field trying to locate the crashed scenic tour helicopter - causes: bad weather, self-induced pressure to continue search | 4 | 0 | 0 | Aerospatiale AS-350-B2 |
| 9/10/99 | Juneau, AK | A third helicopter from same scenic tour company crashed into ice field trying to locate first and second crashed helicopters - causes: bad weather, self-induced pressure to continue search | 2 | 0 | 0 | Aerospatiale AS-350-B2 |
| 12/28/99 | Santa Catalina Island, CA | Pilot noticed “power decay,” made emergency landing and helicopter rolled into a ravine - passenger felt the helicopter "shake" - cause: undetermined | 7 | 7 | 0 | Aerospatiale AS-350-D |
| **2000** | | | | | | |
| 4/2/00 | Stillaguamish River, WA | Pilot heard a "clunk" and engine began to race - helicopter hit electrical fence while making emergency landing - helicopter was partially consumed in fuel-fed fire - cause: oil leak caused rotor clutch to disengage from engine | 3 | 2 | 1 | Bell 47G-3B-1 |
| 4/16/00 | Grand Canyon, AZ | Pilot felt “abnormal vibration” and made emergency landing near the canyon, damaging the helicopter - cause: undetermined | 6 | 0 | 0 | Bell 407 |
| 4/18/00 | Grand Canyon, AZ | Pilot lost power on takeoff and made emergency landing, narrowly missing power lines - possible cause: snow may have blown into air inlets the previous night | 7 | 7 | 0 | Bell 206L-3 |
| 4/21/00 | Kahului, HI | Helicopter lost engine power, pilot made emergency landing, bounced into edge of an unseen ravine - cause: undetermined | 6 | 0 | 0 | Aerospatiale AS-350-BA |
| 5/27/00 | Fort Walton Beach, FL | Helicopter lost power on takeoff and crashed about 20 yards offshore - cause: undetermined | 3 | 0 | 0 | Bell 47G2 |
| 6/17/00 | Ruidoso, NM | Pilot reported "problem with the engine" and made a forced landing- cause: undetermined | 3 | 3 | 0 | Enstrom 280-C |
| 7/2/00 | Willamette River, OR | Helicopter made rough landing after passengers heard "popping" noise from engine or rotor at 500 feet AGL - cause: undetermined | 4 | 1 | 0 | Fairchild-Hiller FH-1100 |

| Date | Where | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 7/21/00 | Kahului, HI | Helicopter crashed into the 60-degree north face of a volcano at 2,850 feet elevation MSL - cause: undetermined | 7 | 0 | 7 | Aerospatiale AS-355-F1 |
| 9/18/00 | Hoover Dam, AZ | After taking off in Las Vegas, Nevada, pilot crash-landed near Hoover Dam due to engine failure - cause: undetermined | 7 | 7 | 0 | Sikorsky/ Orlando S-55 |
| 10/13/00 | Hilo, HI | Pilot being trained for heli-tour flights crash-landed when tail assembly fell off helicopter during practice hovering - pilot reported "obvious component failure" felt throughout the airframe - cause: undetermined | 2 | 0 | 0 | Aerospatiale AS-350-BH |
| **2001** | | | | | | |
| 2/1/01 | Lihue, HI | Pilot experienced a “hydraulic hardover” and the helicopter flipped over on runway - cause: undetermined | 2 | 1 | 0 | Aerospatiale 350 |
| 3/10/01 | Orlando, FL | Pilot reported seeing engine smoking and made emergency landing. Helicopter then caught fire and was destroyed. | 3 | 0 | 0 | Enstrom F-28C |

Source: NTSB database at http://www.ntsb.gov/NTSB/query.asp. Note on definitions of scenic heli-tour accidents: A handful of flights characterized as sight-seeing flights in the NTSB database were omitted because they weren't part of organized and on-going scenic tour operations. Most were demonstration rides at air shows or county fairs. Crashes during point-to-point air-taxi flights flown by scenic air tour operators were also omitted. At the same time, a handful of other accidents not described as sightseeing flights in the NTSB database were included. These were training flights and rescue flights that were part of ongoing scenic tour operations.

# APPENDIX 3

## *HIGH “DENSITY ALTITUDE” HELICOPTER ACCIDENTS IN THE WEST (1996-2000)*

| Date | Place | Density altitude calculated by NTSB (in feet) | Scenic Tour? |
|---|---|---|---|
| 9/4/96 | Sheridan, Wyoming | 11,600 | No |
| 8/15/97 | Tahoe City, California | 9,500 | No |
| 8/19/97 | Montrose, Colorado | 11,300 | No |
| 9/30/97 | Morgan, Utah | 9,043 | No |
| 7/17/98 | Olathe, Colorado | 8,900 | No |
| 7/22/98 | Idaho Falls, Idaho | 5,500 | No |
| 8/22/98 | Naurita, Colorado | 9,500 | No |
| 9/29/98 | Price, Utah | 10,775 | No |
| 5/22/99 | Baggs, Wyoming | 7,500 | No |
| 6/22/99 | Telluride, Colorado | 13,000 | Yes |

Source: NTSB database at http://www.ntsb.gov/NTSB/query.asp

# APPENDIX 4

## *AEROSPATIALE 350 SERIES HELICOPTER ACCIDENTS WITH UNDETERMINED CAUSES (1996-2001)*

### (AS DESCRIBED IN PRELIMINARY NTSB ACCIDENT REPORTS IN NTSB DATABASE*)*

| Date | Where | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| **1998** | | | | | | |
| 6/5/98 | La Gloria, TX | Medevac pilot crashed without radioing any distress call | 3 | 0 | 3 | AS-350-BA |
| 6/25/98 | Mount Waialeale, HI | Scenic tour helicopter crashed on Mount Waialeale volcano | 6 | 0 | 6 | AS-350-BA |
| **1999** | | | | | | |
| 3/17/99 | Gulf of Mexico | Pilot servicing the Eugene Island 193 oil platform crashed upside down into the Gulf after witnesses on the platform heard a “loud bang” | 4 | 2 | 2 | AS-350B2 |
| 12/28/99 | Avalon, CA | Pilot of a scenic tour flight over Santa Catalina Island made an emergency landing after an unexplained loss of power, then flipped over into a ravine -pilot reported having seen a “Low RPM” warning light | 7 | 7 | 0 | AS-350D |
| **2000** | | | | | | |
| 3/26/00 | Van Nuys, CA | Pilot of a news helicopter covering the Academy Awards reported a loss of hydraulic power and crashed trying to return to base | 2 | 2 | 0 | AS-350B |
| 4/21/00 | Kahului, HI | Pilot of a scenic tour operator crashed in rough mountainous terrain. The pilot radioed that the helicopter had lost engine power | 6 | 0 | 0 | AS-350BA |
| 5/4/00 | Blanding, UT | Pilot trying to land on a mesa crashed without explanation | 6 | 3 | 3 | AS-350B |
| 5/11/00 | Mesa, AZ | Helicopter damaged in rough landing after pilot reported the controls got "very stiff" | 3 | 0 | 0 | AS-350B2 |
| 5/24/00 | Patterson, LA | Pilot crashed while trying to land after a flight from an oil platform in the Gulf of Mexico. Pilot reported that the hydraulic system had failed | 2 | 2 | 0 | AS-350B |
| 7/21/00 | Kahului, HI | Scenic tour helicopter crashed into a mountainside without radioing any indication of malfunctions | 7 | 0 | 7 | AS-355F1 |

| Date | Where | What Happened | Aboard | Injured | Killed | Type |
|---|---|---|---|---|---|---|
| 7/24/00 | Sumner, GA | Medevac pilot crashed without radioing any distress call | 3 | 0 | 3 | AS-350B |
| 10/3/00 | El Cajon, CA | The helicopter designated for scenic tours in Teton County, Wyoming slammed into runway, suffering "substantial damage" - pilot said he noticed “something fly off the helicopter” and then made a “hard landing” (For details, see Appendix 5 on page 42.) | 2 | 0 | 0 | AS-350BA |
| 10/13/00 | Hilo, HI | Pilot being trained for heli-tour flights crash-landed when tail assembly fell off helicopter - pilot reported "obvious component failure" felt throughout the airframe | 2 | 0 | 0 | AS-350BA |
| 10/16/00 | Burlington, NC | Medevac pilot crashed in Burlington, North Carolina, after indications of low transmission oil pressure | 1 | 0 | 1 | AS-355B2 |
| 10/22/00 | Kamuela, HI | Pilot crash-landed after losing engine power - post-accident inspection of the engine showed that the engine compressor had apparently “seized” | 1 | 1 | 0 | AS-350-BA |
| 10/28/00 | Gulf of Mexico | Pilot flying to an oil rig radioed a distress call, “I’m going down” - helicopter plunged into the Gulf | 1 | 0 | 1 | AS-350BA |
| 12/7/00 | Henderson, NV | Pilot carrying FAA inspector collided with rock during hard landing from a "pinnacle approach" | 3 | 0 | 0 | AS-350BA |
| **2001** | | | | | | |
| 2/1/01 | Lihue, HI | Pilot of scenic tour helicopter experienced “hydraulic hardover” and the helicopter flipped over on runway | 1 | 1 | 0 | AS-350 |
| 2/27/01 | Powder River, WY | Helicopter from Canada collided with utility box while landing on field after pilot lost control | 1 | 0 | 0 | AS-350B2 |
| 3/11/01 | Mazama, WA | Helicopter hit downdraft and rolled over while pilot was trying to reposition helicopter for landing during helicopter skiing trip. | 6 | 1 | 0 | AS-350B2 |
| 3/17/01 | Hayward, CA | Pilot of police helicopter hit power lines during emergency landing | 3 | 0 | 0 | AS-350B2 |

Source: NTSB database at http://www.ntsb.gov/NTSB/query.asp

# APPENDIX 5

## *NTSB PRELIMINARY REPORT ON VORTEX HELICOPTER ACCIDENT*

NTSB Identification: **LAX01LA009**

Accident occurred Tuesday, October 03, 2000 at EL CAJON, CA

Aircraft: Aerospatiale AS350BA, registration: N189ND

Injuries: 2 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On October 3, 2000, at 1430 hours Pacific daylight time, an Aerospatiale AS350BA, N189ND, made a hard landing following a tail boom strike at Gillespie Field Airport, El Cajon, California. The tail boom strike occurred as the pilot was attempting to land on a cart used to move the helicopter on the ground. Vortex Helicopters, LLC, operated the helicopter under the provisions of 14 CFR Part 91. The helicopter sustained substantial damage. The airline transport pilot and one passenger were not injured. Visual meteorological conditions prevailed for the positioning flight and no flight plan was filed.

In an interview with a Federal Aviation Administration (FAA) inspector, the pilot stated that he was repositioning the helicopter from the ground parking spot to a wheeled cart to place it in a hangar for storage. While he was attempting to land on the cart, he saw something fly off the helicopter and experienced difficulty maintaining directional control. He stated that he suspected a tail rotor failure and decided to land on the ground because he was not positioned properly to land on the cart. After clearing the landing cart, the helicopter landed hard, damaging the tail boom.

The FAA inspector also interviewed two witnesses to the accident. Both witnesses stated that the pilot made three unsuccessful attempts to land on the landing cart. On the fourth attempt, they noted the helicopter was moving up and down, but was not landing. The helicopter then fell left skid low, and the tail boom struck the landing cart. It came back into the air, rotated off the landing cart, and landed on the ground. After the tail boom struck the trailer both witnesses saw a part, later identified as a coupling from the tail rotor drive shaft, come off the tail rotor.

Source: go to http://www.ntsb.gov/NTSB/query.asp and search the database using the phrase "Vortex Helicopters."

# APPENDIX 6

## *SPECIAL FAA RULE COVERING AIR TOURS IN HAWAII, PUBLISHED IN FEDERAL REGISTER SEPTEMBER 29, 2000 (Abbreviated)*

### Special Federal Aviation Regulation No. 71

### Special Operating Rules for Air Tour Operators in the State of Hawaii

Section 2. Definitions. For the purposes of this SFAR: “Air tour” means any sightseeing flight conducted under visual flight rules in an airplane or helicopter for compensation or hire.

* * *

Section 4. Helicopter performance plan. Each operator must complete a performance plan before each helicopter air tour flight. The performance plan must be based on the information in the Rotorcraft Flight Manual (RFM), considering the maximum density altitude for which the operation is planned for the flight to determine the following:

(a) Maximum gross weight and center of gravity (CG) limitations for hovering in ground effect;

(b) Maximum gross weight and CG limitations for hovering out of ground effect; and,

(c) Maximum combination of weight, altitude, and temperature for which height-velocity information in the RFM is valid.

The pilot in command (PIC) must comply with the performance plan.

Section 5. Helicopter operating limitations. Except for approach to and transition from a hover, the PIC shall operate the helicopter at a combination of height and forward speed (including hover) that would permit a safe landing in event of engine power loss, in accordance with the height-speed envelope for that helicopter under current weight and aircraft altitude.

Section 6. Minimum flight altitudes. Except when necessary for takeoff and landing, or operating in compliance with an air traffic control clearance, or as otherwise authorized by the Administrator, no person may conduct an air tour in Hawaii:

(a) Below an altitude of 1,500 feet above the surface over all areas of the State of Hawaii, and,

(b) Closer than 1,500 feet to any person or property; or,

(c) Below any altitude prescribed by federal statute or regulation.

Section 7. Passenger briefing. Before takeoff, each PIC of an air tour flight of Hawaii with a flight segment beyond the ocean shore of any island shall ensure that each passenger has been briefed on the following, in addition to requirements set forth in 14 CFR 91.107, 121.571, or 135.117:

(a) Water ditching procedures;

(b) Use of required flotation equipment; and

(c) Emergency egress from the aircraft in event of a water landing.

**Source:** http://www.faa.gov. Note: RFM is an abbreviation for Rotorcraft Flight Manual

# APPENDIX 7

## *EXCERPTS OF 1997 FAA REGULATION BANNING SCENIC AIR TOURS IN ROCKY MOUNTAIN NATIONAL PARK, COLORADO*

### SPECIAL FEDERAL AVIATION REGULATION NO. 78

### Special Flight Rules in the Vicinity of the Rocky Mountain National Park; Final Rule (Effective Date: February 7, 1997)

SUMMARY: This action establishes a temporary Special Federal Aviation Regulation (SFAR) at Rocky Mountain National Park (RMNP) to preserve the natural enjoyment of visitors to RMNP by preventing any potential

adverse noise impact from aircraft-based sightseeing overflights. This action temporarily bans commercial air tour operations over RMNP while the FAA develops a broader rule that will apply to RMNP as well as other units of the National Park system. The final rule will expire as soon as a general rule on such overflights is adopted.

Background

The designation of an area as a National Park is one of the highest recognition given to any area in the country for its natural beauty and the importance of its protection. In view of the significance of this designation, Congress requires that National Parks by *(sic)* managed consistently with the ``high public value and integrity of the National Park System and [such management] shall not be exercised in derogation of the values and purposes for which these areas have been established to conserve the scenery and the nature and the historic objects and the wildlife therein, and to leave them unimpaired for future generations.

FAA Statutory Authority

The FAA has broad authority and responsibility to regulate the operation of aircraft and the use of the navigable airspace and to establish safety standards for and regulate the certification of airmen, aircraft, and air carriers. 49 U.S.C. 40104, et seq., 49 U.S.C. 40103(b). Subtitle VII of Title 49 U.S.C. provides guidance to the Administrator in carrying out this responsibility. However, the FAA's authority is not limited to regulation for aviation safety and efficiency.

The FAA has authority to manage the navigable airspace to protect persons and property on the ground. The Administrator is authorized to ``prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes) for * * *. *(Authors note: "* * *" in original)* (B) protecting individuals and property on the ground" 49 USC 40103(b)(2). In addition, under 49 USC Section 44715(a) the Administrator of the FAA, in consultation with the Environmental Protection Agency, is directed to issue such regulations as the FAA may find necessary to control and abate aircraft noise and sonic boom to ``relieve and protect the public health and welfare."

The FAA construes these provisions, taken together, to authorize the adoption of this regulation, which is intended to minimize the limit the *(sic)* adverse effects of aircraft noise to protect visitor enjoyment of RMNP. The FAA finds that the regulation of the navigable airspace, as authorized under 49 U.S.C. 40103(b)(2), is necessary, on a temporary, limited basis, as discussed below, to control and abate aircraft noise at RMNP under 49 U.S.C. 44715. Current policies support the exercise of FAA authority to protect the RMNP in these unique circumstances, at least as an interim step while the FAA proceeds to complete a rulemaking that will address the larger issue of protecting national parks. See generally, Section 101 of the National Environmental Policy Act of 1969, as amended 42 U.S.C. 4321 and Executive Order 11514, as amended by Executive Order 11991.

* * *

RMNP receives approximately three million visitors a year, making it the sixth most visited national park in the United States, despite its relatively small size (for a major Western national park) of 265,727 acres. RMNP is located approximately 40 miles outside the city limits of Denver, Colorado, and approximately 50 miles from the Denver International Airport. The topography of the park is characterized by steep mountains, narrow valleys, and high elevations (8,000 to 14,250 ft). Seventy percent of park terrain is above 10,000 feet.

**Source:** http://www.airportnet.org/depts/federal/rules/rocky.htm

# APPENDIX 8

## *FAA ADVISORY VISUAL FLIGHT RULES FOR FLIGHTS OVER WILDERNESS AREAS AND WILDLIFE REFUGES (This appendix includes excerpts from two FAA documents.)*

## 1)
## ADVISORY CIRCULAR 91-36C - VISUAL FLIGHT RULES (VCR) FLIGHT NEAR NOISE SENSITIVE AREAS

**DEPARTMENT OF TRANSPORATION**
**FEDERAL AVIATION ADMINISTRATION**
**10/19/84**

1**. PURPOSE.**
This advisory circular encourages pilots making VFR flights near noise sensitive areas to fly at altitudes higher than the minimum permitted by regulation and on flight paths which will reduce aircraft noise in such areas.

* * *

**2. BACKGROUND**

* * *

c. Excessive aircraft noise can result in discomfort, inconvenience, or interference with the use and enjoyment of property, and can adversely affect wildlife.

* * *

**Source: Summit Aviation's *Computerized Aviation Reference Library***

## 2)
## EXCERPT FROM FAA'S CURRENT AERONAUTICAL INFORMATION MANUAL, RESTATING THE 1984 ADVISORY CIRCULAR. (The "NOTE" below is quoted from the Aeronautical Information Manual. )

### Section 7-4-6. Flights Over Charted U.S. Wildlife Refuges, Parks and Forest Service Areas

* * *

*(b) Pilots are requested to maintain a minimum altitude of 2,000 feet above the surface of the following: National Parks, Monuments, Seashores, Lakeshores, Recreation Areas and Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service.

NOTE -
FAA Advisory Circular AC-91-36, Visual Flight Rules (VFR) Near Noise-Sensitive Areas, defines the surface of a national park area (including parks, forests, primitive areas, wilderness areas, recreation areas, national seashores, national monuments, national lakeshores, and national wildlife refuge and range areas) as: the highest terrain within 2,000 feet laterally of the route of flight, or the upper-most rim of a canyon or valley."

Source: http://www.faa.gov/Atpubs/AIM/Chap7/aim0704.html.

# APPENDIX 9

## *EXCERPT FROM "AVIATION NOISE EFFECTS," PUBLISHED BY THE FAA IN MARCH 1985*

Section 3.0 ANNOYANCE AND AIRCRAFT NOISE

INTRODUCTION

The typical response of humans to aircraft noise is annoyance. Annoyance response is remarkably complex and, considered on an individual basis, displays wide variability for any given noise level. Fortunately, when one considers average annoyance reactions within a community, one can develop aggregate annoyance response/noise level relationships. This section introduces the reader to the factors which influence individual annoyance response. Also included are examples of research findings which display aggregate community annoyance responses.

* * *

3.3 VARIABLES AFFECTING RESPONSE

Individual human response to noise is subject to considerable natural variability, over the past 35 years, researchers have identified many of the factors which contribute to the variation in human reaction to noise.

3.3.1 Emotional Variables. Knowledge of the existence of these individual variables helps to understand why it is not possible to state simply that a given noise level from a given noise source will elicit a particular community reaction or have a certain environmental impact. In order to do that, it would be necessary to know how much each variable contributes to human reaction to noise. Research in psychoacoustics has revealed that an individual's attitudes, beliefs and values may greatly influence the degree to which a person considers a given sound annoying. The aggregate emotional response of an individual to noise has been found to depend on:

A. Feelings about the Necessity or Preventability of the Noise. If people feel that their needs and concerns are being ignored, they are more likely to feel hostile towards the noise. This feeling of being alienated or of being ignored and abused is the root of many human annoyance reactions. If people feel that those creating the noise care about their welfare and are doing what they can to mitigate the noise, they are usually more tolerant of the noise and are willing and able to accommodate higher noise levels.

B. Judgment of the Importance and Value of the Activity which is Producing the Noise. If the noise is produced by an activity which people feel is vital, they are not as bothered by it as they would be if the noise-producing activity was considered superfluous.

C. Activity at the Time an Individual Hears a Noise. An individual's sleep, rest and relaxation have been found to be more easily disrupted by noise than his communication and entertainment activities.

D. Attitudes about Environment. The existence of undesirable features in a person's residential environment will influence the way in which he reacts to a particular intrusion.

E. General Sensitivity to Noise. People vary in their ability to hear sound, their physiological predisposition to noise and their emotional experience of annoyance to a given noise.

F. Belief about the Effect of Noise on Health. The extent to which people believe that exposure to aircraft noise will damage their health affects their response to aviation noise.

G. Feeling of Fear Associated with the Noise. For instance, the extent to which an individual fears physical harm from the source of the noise will affect his attitude toward the noise.

3.3.2 Physical Variables. A number of physical factors have also been identified by researchers as influencing the way in which an individual may react to a noise. These factors include:

A. Type of Neighborhood. Instances of annoyance, disturbance and complaint associated with a particular noise exposure will be greatest in rural areas, followed by suburban and urban residential areas, and then commercial and industrial areas in decreasing order. The type of neighborhood may actually be associated with one's expectations regarding noise there. People expect rural neighborhoods to be quieter than cities. Consequently, a given noise exposure may produce greater negative reaction in a rural area.

B. Time of Day. A number of studies has suggested that noise intrusions are considered more annoying in the early evening and at night than during the day.

C. Season. Noise is considered more disturbing in the summer than in the winter. This is understandable since, during the summer, windows are likely to be open and recreational activities take place out of doors.

D. Predictability of the Noise. Research has revealed that individuals exposed to unpredictable noise have a lower noise tolerance than those exposed to predictable noise.

E. Control over the Noise Source. A person who has no control over the noise source will be more annoyed than one who is able to exercise some control.

F. Length of Time an Individual Is Exposed to a Noise. There is little evidence supporting the argument that annoyance resulting from noise will decrease with continued exposure; rather, under some circumstances, annoyance may increase the longer one is exposed.

Source: available at http://www.nonoise.org/library/ane/ane.htm.

# APPENDIX 10

## *A NOTE ON HOW SOUND AND NOISE ARE MEASURED*

Sound is a vibration transmitted through the air in waves until they reach the listener. The waves behave much like ripples traveling in a pond. The decibel (dB) is a commonly accepted shorthand way of expressing the amplitude of the sound waves. The range of sounds extends from from 20 to 120 decibels. An increase or decrease in decibels is measured on an exponential rather than a straight-line scale. Thus a 10 decibel increase in sound seems twice as loud to a listener. A 10 decibel decrease in sound seems half as loud to a listener. In general, changes in sound level of 3 or 4 dB are barely perceptible. The FAA uses various adjustments of the raw decibel measurements to best express the annoyance of airport noise as perceived by a human listener, but it has no scientific method of measuring the impact of aviation noise on animals.

- A-weighted Sound Level is a measure of the sound level in decibels. The raw sound level is filtered to approximate the human assessment of sound levels by reducing the influence of high and low level extremes. A-weighted Sound Level is used by the FAA, the National Park Service and other agencies as a standard for measuring sound in the environment.

- Effective Perceived Noise Level (ENPL) is a more sophisticated measurement in decibels used by the FAA for noise certification of helicopters. It is meant to approximate the "human annoyance responses" of aircraft flyover noise. It takes into account the pitch of the noise and the duration of the overflight.

A 1988 cooperative research project between the U.S. Fish and Wildlife Service and the U.S. Air Force found that the widely-used sound weightings used in calculating A-weighted sound levels are not applicable to the way sound is perceived by either wild or domesticated animals. The study found that no methodology had been developed to make an impact assessment of the effect of sound on animals.

Source: FAA, "Aviation Noise Effects" (Washington, DC: 1985), available at http://www.nonoise.org/library/ane/ane.htm, and U.S. Fish and Wildlife Service, "The Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A literature synthesis" (Fort Collins, Colorado: 1988) available at http://www/nonoise.org/library/animals/litsyn.htm.

# APPENDIX 11

## *A NOTE ON SCENIC AIR TOUR STATISTICS*

Despite pressure from the NTSB, the NTSB, DOT and FAA have not agreed on a methodology for developing statistics that would reveal trends in the safety and growth of the air tour industry. As a result, the NTSB's annual reports on aviation safety trends do not contain statistics on the safety of scenic air tours. In 1995, after a special investigation of 139 accidents involving fixed-wing aircraft and helicopters in the air tour industry between 1988 and 1995, the NTSB formally asked the DOT to develop statistics on the industry as a guideline for FAA staffing in regions where there are scenic air tours. On June 11, 1997, the DOT replied that "establishing a database on the operations of air tour operators presents a number of difficult issues. The DOT has not developed a satisfactory solution for determining the population of air tour operators or their scale of operations. Identifying air tour operators in areas other than the Grand Canyon and Hawaii has been difficult." (See DOT letter dated 8/26/97, FAA Report No. A-95-65. To find it, go to http://nasdac.faa.gov/asp/asy_searchus.asp and search for the phrase "air tour.")

Lacking official estimates on the number of scenic tour helicopters, the authors of this report developed two independent methods for estimating the percentage of all U.S.-registered helicopters that are devoted to scenic tours. The two methods reached the same result: that only about 2.5% of all U.S.-registered helicopters have been devoted to scenic tours. Here are the two methods:

(1) Using the Rotor Roster 2001 database and the websites of the U.S. Air Tour Association and all scenic tour operators advertising on the internet, the authors identified 250 helicopters that were part of the scenic tour fleets of known heli-tour companies in 2000. The authors assumed that another 50 scenic tour helicopters might somehow have been missed in this database and internet search. Taken together, these figures indicated that about 250-300 helicopters were devoted to scenic helicopter tours in 2000. It was known from the Rotor Roster 2001 database that a total of 11,409 helicopters were registered in the fifty states in 2000. That meant 250-300 of the 11,409 civilian helicopters were devoted to scenic tours. In percentage terms, that worked out to 2.2% - 2.6% of all civilian helicopters in 2000.

(2) The website of the Helicopter Association International (HAI) -- http://www.rotor.com.-- contained data from a 1998 HAI "Survey of Helicopter Tour Operators." The survey showed that in 1995, 121 helicopters were used in commercial air tour operations. In the same year there were 9,712 civilian helicopters registered in the United States, according to the Rotor Roster 2001 database (see Table 5 on page 15). By combining HAI and Rotor Roster data, the authors calculated that 1.2% of all helicopters were involved in scenic tours in 1995. The HAI survey also found that the number of helicopters involved in tour operations rose to 139.5 in 1996 and 167.25 in 1997. This represented a 19% annual growth rate of scenic tour helicopters from 1995 to 1997 -- the latest years for which the HAI website made

such data available. (The fractions in the HAI's numbers of helicopters devoted to scenic tours apparently resulted from responses of some HAI members that they used their helicopters partly for scenic tours and partly for other uses.) Since there was no HAI survey counting the number of heli-tour helicopters in 1998-2000, the authors made a projection based on an assumption. The assumption was that the number of scenic tour helicopters continued growing at the same annual rate of 19% through 2000. Using that assumption, it was possible to project that by 2000 there were 283 scenic tour helicopters. When converted to percentage terms, that projected number of scenic tour helicopters worked out to 2.5% of the 11,409 civilian helicopters registered in the 50 states.

## APPENDIX 12

### *PROSPECTIVE TOUR OPERATOR'S RESPONSE TO A DRAFT OF PART 1 OF THIS REPORT (LETTER POSTMARKED MARCH 10, 2001 IN SAN DIEGO, CALIFORNIA)*

# Vortex Aviation Services, LLC

1946 Joe Crosson Drive
El Cajon, California 92020
619.448.3307
fax 619.448.3353

February 27, 2001

Joe Albright
Flat Creek Ranch
PO Box 9760
Jackson, WY 83002

Dear. Mr. Albright:

I am in receipt of your letter dated February 21 with your 14 pages of research entitled "WHAT YOU SHOULD KNOW ABOUT SAFETY OF HIGH-ALTITUDE SCENIC HELICOPTER TOURS." Let me say first that my response here is simply a matter of courtesy since you have requested my comments and suggestions. I must say that I do not consider you to be a qualified expert on aviation issues regardless of your claim to have been a passenger in helicopters in the past. I doubt that even you would put yourself in the category of an expert.

In your cover letter you refer to "unsettling safety problems" and your report seems to link these with the use of the A-Star. You are obviously unaware that the A-Star is the aircraft of choice for virtually all air tour operators because of its safety record and passenger considerations. Further, Aerospatiale helicopters are often the aircraft of choice for search and rescue and EMS operations. Your conclusions are of such a serious nature that I have forwarded the entire document to the manufacturer, American Eurocopter in Grand Prairie, Texas. I was somewhat surprised to hear that you had not sent them a copy directly. If your concerns were sincere, I would have expected you to notify the manufacturer of the helicopter immediately. If your "report" was not meant to be evaluated by acknowledged experts and those in a position to effect change, who is it meant for and to what end?

Safety of flight which ensures the safety of our passengers is the priority interest of Vortex Aviation Services. In this regard we meet, and exceed, FAA regulations. Our pilots and mechanics are all subject to drug and alcohol testing, our pilots are regularly tested by the FAA, and a flight following procedure is in place for every charter and scenic air tour flight. Our aircraft are maintained by the highest standards of FAA requirements, Part 135. Beyond what

is mandated by the FAA, Vortex only operates aircraft with ELTs (Emergency Locator Transmitters), high visibility blade markings and all aircraft carry survival and first aid equipment. Your recommendation that we install a radar altimeter shows me that your research is incomplete and you know very little about our type of operations. Perhaps that is why you were unable to recommend a safer helicopter.

Vortex is a member of the Helicopter Tour Operator Committee of the HAI (Helicopter Association International) and this membership keeps us abreast with the latest safety issues and concerns as air tour operators. We have not seen anything coming from the HAl or the FAA that reflects your "findings."

The next major concern of Vortex is to mitigate the impact we might have on wildlife, the environment and those who have ventured into the back country to enjoy it. Accordingly, we have met with representatives of the National Forest Service and National Park Service to begin dialogue that will result in providing us with an understanding of these issues and ways that we can conduct air tours that meet our mutual goals.

Your comments on the value of having back up helicopters available did touch on one area that has been on my mind. Last year I was approached by a Jackson businessman who asked me to consider a proposal to be reimbursed for our expenses associated with setting up our air tour operations in Jackson in exchange for our withdrawal of our plans to operate air tours out of Jackson. The concept may have merit with regard to public safety. As a result, we have already met with representatives from law enforcement and search and rescue to assess their need and offer our services. While there is seasonal contract helicopter service in the area, there is no EMS helicopter that can service the Teton and Yellowstone areas well, nor is there an EMS helicopter that is based in the area. If you would be willing to coordinate a coalition that would fund Vortex to set up helicopter EMS services for the Yellowstone-Teton corridor, we would be willing to consider foregoing our rights to operate scenic helicopter tours in the Jackson area.

You are correct in noting that "scenic air tours are going to come". If we are to offer this service we are committed to the highest standards in safety, and our support of the environmental goals of, the National Forest Service, National Park Service and the BLM. We have already secured the offer of cooperation of those we have met with this winter and we expect that you will lend your support to these goals.

Very truly yours,
Vortex Aviation Services

(signature)

Gary J. Kauffman
Managing Member

/ap

Source: The original letter is in the authors' files.

Note: The final paragraph of Mr. Kauffman's letter contained the following partial quotation taken from a draft of this report: "helicopter scenic tours are going to come." To avoid misinterpretation, here is the full sentence from which this partial quotation was taken: "All sides in the Jackson Hole scenic tour controversy agree that if helicopter scenic tours are going to come, they must be as safe as humanly possible."

# APPENDIX 13

## *NTSB REPORT ON HIGH DENSITY ALTITUDE ACCIDENT IN TELLURIDE, COLORADO (EXCERPTS)*

On June 20, 1999, at 1312 mountain daylight time, a Bell 206B helicopter, N39122, landed hard on a road approximately 200 yards short of the point of intended landing at Telluride Regional Airport, Telluride, Colorado. One commercial pilot and one passenger received serious injuries and the other commercial passenger and passenger received minor injuries. The helicopter sustained substantial damage . . . .

According to the operator, the flight was for the purpose of introducing local persons to the operation of the helicopter as an air tour vehicle under Title 14 CFR 135 doing business as Helicopter Services Telluride (HST) . . . . At the time of the accident two local persons were being given a ride to introduce them to the service and the company pilot was building experience with oversight provide by a safety pilot . . . .

According to the safety pilot, about 100 to 150 feet above the ground, on a heading of 270 degrees the pilot allowed the helicopter to "slow up too much" and the airspeed went to zero and the sink rate increased rapidly. As he reached for the controls he said the pilot flying "made a significant collective increase drooping RPM and starting a right yaw/spin." At this point, according to the safety pilot, the company pilot took his hands from the controls and said, "you've got it." The safety pilot said he took control, applied forward cyclic, down collective, and "throttle" to idle to stop the spin. He said he then tried to cushion the landing with up collective. The helicopter landed hard with no forward speed and no yaw on a heading of 060 degrees . . . .

. . . . the helicopter exhibited performance characteristics of power settling. This phenomenon ... is described in NASA publications as follows:

* When entering a hover at high gross weights, and/or high altitudes under nearly calm wind conditions, vortex ring state or power settling may result. This condition occurs because vortices are built up at both the tips and along the span of the main rotor blades. A recirculation of air takes place and the helicopter settles into its own rotor wash down flow which decreases the aerodynamic efficiency of the rotor system. The more power (higher angle of attack) selected in attempting to produce adequate lift the less efficient the rotor system becomes due to increased turbulence. An ever-increasing rate of descent is the result. In extreme power settling, the velocity of the recirculating air mass becomes so high that full power can produce a rate of descent in excess of 3,000 feet-per-minute.

* Recovery from this condition is attained by increasing forward speed and rate of descent so that the rotor system "flies" out of the self-induced turbulence. When entering a hover in close proximity to the ground, sufficient altitude may not be available before ground contact is made.

Source: http://www.ntsb.gov/NTSB/query.asp. NOTE: According to FAA documents, the preferred runway for landings at Telluride Regional Airport is at 9,062 feet MSL.

# SOURCING

For FAA air-worthiness directives and other rules flights, see http://www.faa.gov.

For FAA reports on accidents and incidents, see http://nasdac.faa.gov/asp/asy_fids.asp.

For FAA report on how to use aviation accident data, see "Aviation Safety Data Accessibility Study Index" (FAA: January 20, 1997), available at http://nasdac.faa.gov/safety_info_study/.

For the FAA's measurments of the noise of Aerospatiale 350 Series helicopters, see "Noise Measurement Flight Test: Data/Analyses of Aerospatiale AS 350D Astar Helicopter" (FAA, September 1984). The document is not available on the internet but can be purchased from the U.S. Department of Commerce's National Technical Information Service (NTIS). It is one of a series of FAA documents available from NTIS that measure the noise of various models of FAA-certified helicopters.

For NTSB accident reports, see http://www.ntsb.gov/NTSB/query.asp. To download the NTSB's entire accident database, see http://www.ntsb.gov/avdata/.

For NTSB's 1995 special investigation of air tour industry accidents, see "Safety of the Air Tour Industry in the United States" (NTSB Document Number PB95917004, adopted by the board 6/1/95). This is not available on the internet but can be purchased from NTIS.

For NTSB's 1978 special investigation of ELT failures, see "Emergency Locator Transmitters - An Overview," (NTSB Document Number PB293258, adopted by the board 1/26/78). This is not available on the internet but can be purchased from NTIS.

For the FAA response to the NTSB's 1995 investigation, go to http://nasdac.faa.gov/asp/asy_searchus.asp and search for the phrase "air tour."

For a NASA study on helicopter safety based on study of 1,000 NTSB accident reports covering the early and mid-1990s, see http://safecopter.arc.nasa.gov/Pages/XXX.danger.htm.

For reports on investigations of helicopter accidents in Canada, see http://www.tsb.gc.ca.

For reports on investigations of helicopter accidents in New Zealand, see http://www.taic.org.nz.

For New Zealand's advisory to pilots on problems of helicopter flight in high "density altitude" conditions, see Civil Aviation Authority of New Zealand, "Good Aviation Practice: Mountain Flying" (New Zealand, 1999).

For an explanation of “density altitude” and how it is calculated, see http://rshelq.home.sprynet.com/calc_da.htm.

For worldwide helicopter registrations by ownership, manufacturer and locality, see "Rotor Roster 2001," a private database of helicopter information sold in the form of a CD-Rom by Air Track International Aeromarketing of Hilliard, FL (phone: 912-496-3504). Cost: $25.

For safety statistics and other information on helicopters compiled by the Helicopter Association International, the leading helicopter industry group, see http://www.rotor.com.

For the viewpoint of the lobbying group of U.S. air tour operators and for listings of the largest existing heli-tour operators in the country, see http://www.usata.com.

For the website of the American manufacturer of Aerospatiale Series 350 helicopters, see http://www.eurocopterusa.com.

For the website of Vortex Helicopters LLC, see http://www.vortexhelicopters.com.

For 1985 FAA report on the effects of noise on humans and animals, see "Aviation Noise Effects," at http://www.nonoise.org/library/ane/ane.htm.

For 1988 U.S. Fish and Wildlife Service report entitled, "The Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis," see http://www/nonoise.org/library/animals/litsyn.htm,

For 1988 U.S. Fish and Wildlife Service report entitled, "Effects of Aircraft Noise and Sonic Booms on Fish and Wildlife: Results of a Survey of the U.S. Fish and Wildlife Service Endangered Species and Ecological Services Field Offices, Refuges, Hatcheries and Research Centers," see http://www.nonoise.org/library/fishwild/survey.htm.

For 1994 U.S. National Park Service report to Congress on the effects of aviation noise in national parks, see http://www.nonoise.org/library/npreport/intro.htm.

## AUDIENCE

This report is meant to be an accurate information resource for everyone who shares the belief that it would be irresponsible to expose Jackson Hole visitors, residents and wildlife to unnecessary risks from helicopter scenic tours:

- the FAA, DOT and NTSB
- the elected officials at the local, state and federal levels
- the federal and state officials who are custodians of public lands
- the Jackson Hole Airport Board
- the manager and assistant manager of the Jackson Hole Airport
- the prospective Teton County helicopter tour operator and any other prospective operators
- the companies in Jackson Hole and Idaho Falls that for years have operated helicopters for medevac, helicopter skiing, charter transport and other purposes without major accidents
- the hundreds of other members of the local business community, represented by the Jackson Hole Chamber of Commerce
- the manufacturers of scenic tour helicopters
- the HAI, the USATA, the AOPA and other organizations representing helicopter operators, pilots and passengers
- the Teton County Sheriff and the members of his search-and-rescue team
- the conservationists of Jackson Hole and elsewhere
- the more than 6,000 people who have signed petitions against helicopter scenic tours in Jackson Hole
- the potential clients of scenic helicopter tours and their travel agencies

## ABOUT THE AUTHORS

Joe Albright and Marcia Kunstel are journalists, authors and full-time residents of Teton County, Wyoming, and the owners and operators of the Flat Creek Ranch, a guest ranch in Jackson Hole, Wyoming. Their background is that of professional researchers and writers, not of experts on aviation safety. They are indebted to four pilots who helped shape this report by commenting on various drafts. One of the commenters, Mr. Joseph B. Wiley of the Expert Aviation Group of North Palm Beach, Florida, is a recognized expert on helicopter safety and former scenic helicopter tour pilot.

Albright and Kunstel are the co-authors of two non-fiction books on historical topics: "Their Promised Land: Arabs and Jews in History's Cauldron -- One Valley in the Jerusalem Hills" (Crown Books/Random House, 1990) and "Bombshell: The Secret Story of America's Untold Atomic Spy Conspiracy" (Times Books/Random House, 1997).

During their two decades as foreign news correspondents in more than 40 countries, they developed an admiration for the skill and bravery of helicopter pilots and a respect for the uses of helicopters in combat, oil exploration, search-and-rescue and other uses. During the 1999 U.S. Army investigation of two Apache helicopters over the mountains of Albania during the Kosovo crisis, Albright served as a liaison between his journalistic colleagues and the U.S. Army's Task Force Hawk in a position known to journalists and Army officials as “pool coordinator."

Kunstel is a vice-chairman and Albright is a member of the Jackson Hole Conservation Alliance. The Alliance, which dates back to 1979, has 1,844 members and is dedicated to "responsible land stewardship in Jackson Hole, Wyoming, to ensure that human activities are in harmony with the area's irreplaceable wildlife, scenic and other natural resources."