

U.S. DEPARTMENT OF COMMERCE/ National Oceanic and Atmospheric Administration

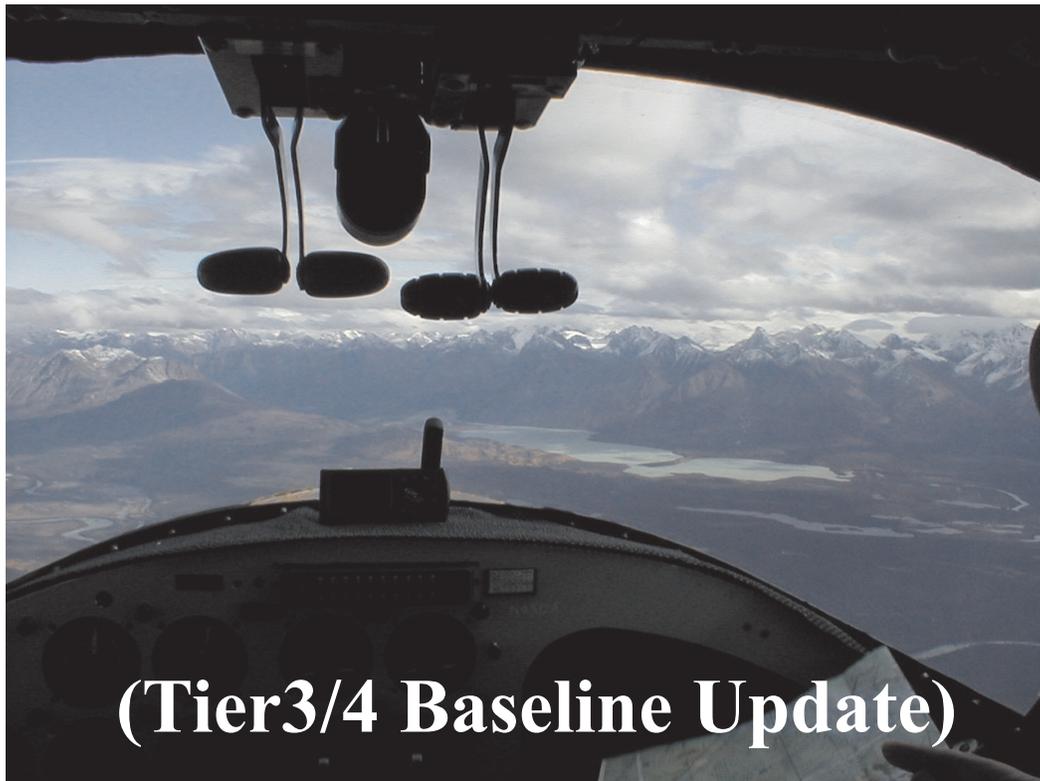
OFCM



OFFICE OF THE FEDERAL COORDINATOR FOR  
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

# AVIATION WEATHER PROGRAMS/PROJECTS

## 2004 UPDATE



**(Tier3/4 Baseline Update)**

Washington, DC  
December 2004

FCM-R21-2004

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## Foreword

This report on aviation weather programs/projects updates the compilation of activities across Federal agencies that began with the *National Aviation Weather Initiatives Final Baseline Tier 3/4 Report*, distributed in 2001. In the time since the compilation effort began, we have largely achieved the objective of identifying in one document all or most of the federally supported research and development (R&D) efforts relevant to reducing weather-related risks to aviation. Many of these activities include industry, university, and association partners.

With this update, we have increased the focus on a second objective of our compilation effort: tracking progress toward completing the R&D phase and transferring the results—whether as specific technology products or as improved information products and services—into aviation operations. This update includes a tabulation by lead agency of programs/projects still under development and those which have moved into the operational phase. A new Highlights section notes some of the substantial achievements of the past year and major milestones toward operational implementation that are planned for fiscal year 2005 or 2006. As in the 2001 *Baseline* report and the 2003 update, details on upcoming milestones and planned operational use are included in Appendix A, which contains a fact sheet for each program/project in our database.

This report also updates and extends the analysis of trends in weather-related aviation accidents that first appeared in the *National Aviation Weather Program Mid-Course Assessment*, published in August 2003. Final data for 2002 from the National Transportation Safety Board have been used to update the trend analysis by aviation regulatory category and by categories of hazardous weather. For the most part, the positive trends identified and highlighted for attention in the *Mid-Course Assessment* are supported by the 2002 data. However, increases over the 2001 rates in fatal weather-related accidents and total weather-related accidents for our general aviation category remind us that the effort to deliver improved weather risk reduction products and services must be supported and sustained. Particularly essential is education and training for all general aviation pilots on how to deal with the deadliest weather-related hazards. Weather hazards will always be with those who fly; our goal must be to continually reduce the risks from encountering these hazards.

Samuel P. Williamson  
Federal Coordinator for Meteorological  
Services and Supporting Research

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## **Aviation Weather Programs/Projects 2004 Update**

This report is the second update to the compilation of aviation weather programs and projects by the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM). The first compilation was released in April 2001 as the *National Aviation Weather Initiatives Final Baseline Tier 3/4 Report*, with a first update released in December 2003 (OFCM 2001, 2003a). Appendix C explains the historical context for this compilation activity, which is conducted under the auspices of the National Aviation Weather Program Council. The second half of this introduction and Appendix D also update the *National Aviation Weather Program Mid-Course Assessment* (OFCM 2003b).

### **AVIATION WEATHER INITIATIVES AND SERVICE AREAS**

*National Aviation Weather Initiatives* (OFCM 1999) defined the eight Service Areas and 86 initiatives used in OFCM reports on Aviation Weather Programs and Projects:

- Ceiling and Visibility (14 initiatives)
- Convective Hazards (12 initiatives)
- En Route Winds and Temperatures (7 initiatives)
- Ground De-Icing and Anti-Icing (6 initiatives)
- In-flight Icing (15 initiatives)
- Terminal Winds and Temperatures (11 initiatives)
- Turbulence (12 initiatives)
- Volcanic Ash and Other Airborne Hazardous Materials (9 initiatives).

As explained in Appendix C, a review of the service areas and initiatives by the participating agencies in 2003 resulted in no changes. Star headings (one to four stars) are applied to the initiatives to indicate the relative priority of initiatives in a service area. Initiatives assigned three or four stars are ranked by the participating agencies as higher in priority than initiatives with one or two stars. The review in 2003 reconfirmed the star rankings used in the *Baseline Tier 3/4 Report*.

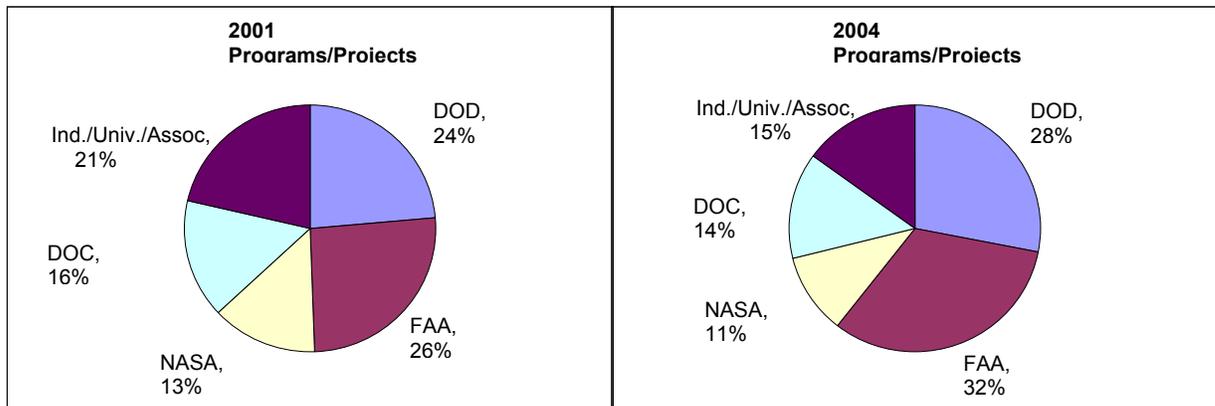
### **FACT SHEET COMPILATION, ANALYSIS, AND IMPLICATIONS**

Fact sheets containing updated 2004 information for each aviation program and project are in Appendix A. Some programs/projects included in the 2003 update have since been terminated or redirected to meet new requirements. The fact sheets are used by the OFCM staff to match aviation weather programs/projects to the aviation weather initiatives. Not all of the programs/projects reported to OFCM match to an initiative, and the compilation effort does not include determining how well or completely the identified programs/projects are satisfying a particular initiative. Program work from only one agency toward an initiative does not necessarily imply insufficient effort on the initiative.

Multiple programs matched to an initiative do not necessarily imply duplication of effort. Initiatives being met by a program from only one agency may be viewed as opportunities for collaboration with other agencies to bring the work to completion. Initiatives being met with programs from multiple agencies may provide opportunities for pooling of resources and opportunities for collaboration.

The table below shows the counts of programs and projects identified this year (2004), compared with the counts in the *Baseline Tier 3/4 Report* (2001) and the 2003 update. As the pie charts illustrate, the identification of additional programs and projects between 2001 and 2003 primarily increased the proportion of *identified* programs/projects led by the Departments of Defense and Transportation. There was little change in numbers of identified aviation programs/projects during the past year. The FAA added programs for volcanic ash and flight level winds.

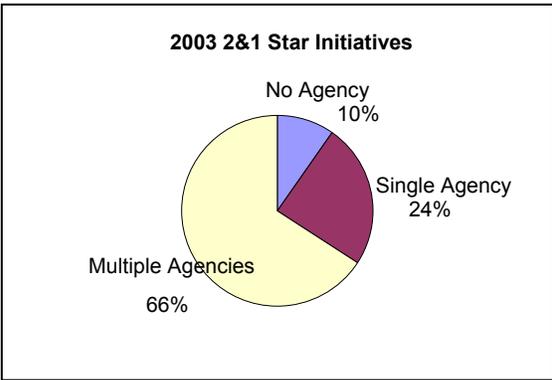
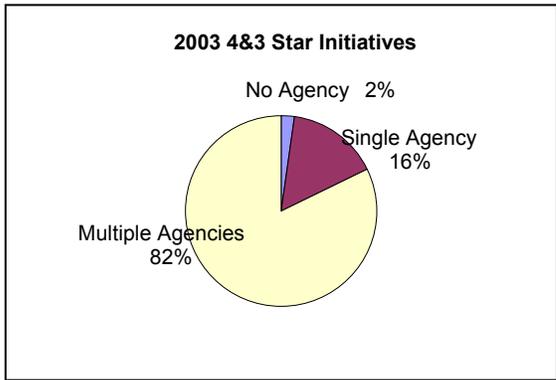
Lead Agency	Programs and Projects		
	2001	2003	2004
Department of Defense	21	40	39
Department of Transportation Federal Aviation Administration	23	43	45
National Aeronautics and Space Administration	12	15	15
Department of Commerce National Oceanic and Atmospheric Administration	14	19	19
Industry/University/ Association Partners	19	23	21
<b>TOTAL</b>	<b>89</b>	<b>140</b>	<b>139</b>



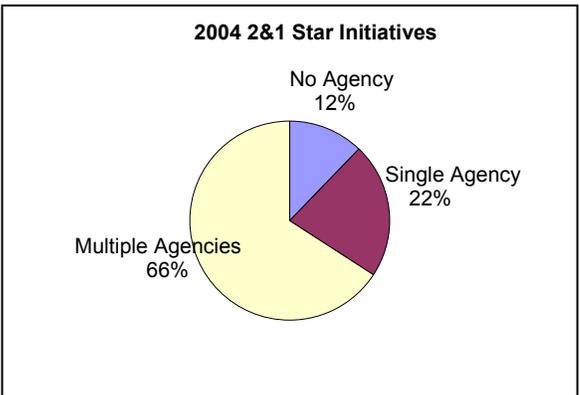
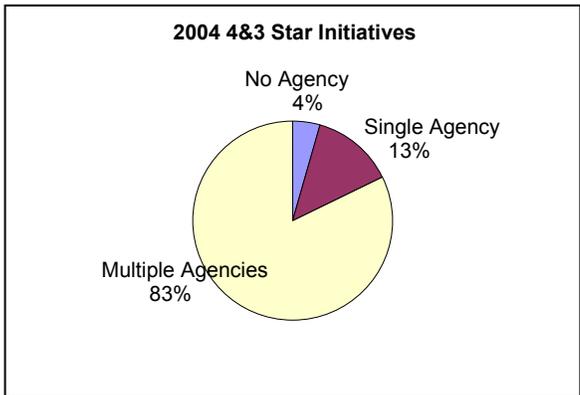
**Match of Program/Projects to Initiatives**

The match of programs/projects to initiatives has been reported since the *Baseline Tier 3/4 Report*. The following tables and graphs show that there was little change this year in the match of projects to four- and three-star initiatives and two- and one-star initiatives. The matrices showing the match of individual programs/projects to each initiative are in Appendix B.

<b>2003 Match</b>	<b>4 &amp; 3 Star Initiatives</b>	<b>2 &amp; 1 Star Initiatives</b>	<b>Total</b>
No Agency	1	4	5
Single Agency	7	10	17
Multiple Agencies	37	27	64
<b>TOTAL</b>	<b>45</b>	<b>41</b>	<b>86</b>



<b>2004 Match</b>	<b>4 &amp; 3 Star Initiatives</b>	<b>2 &amp; 1 Star Initiatives</b>	<b>Total</b>
No Agency	2	5	7
Single Agency	6	9	15
Multiple Agencies	37	27	64
<b>Total</b>	<b>45</b>	<b>41</b>	<b>86</b>



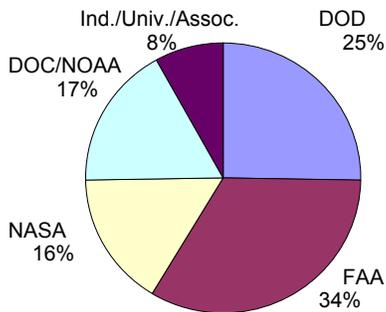
**Operational/Completed Programs by Agency**

The compilation of programs/projects is now in its fourth year. As one should expect, a number of those identified have been completed and their products are being transitioned to operations. The following table shows the number of programs/projects still in development and those that have been completed or otherwise transitioned to operations. The graphics show the distribution by lead agency of projects/programs still in development and of all projects/programs.

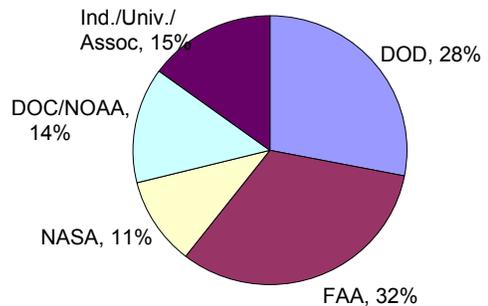
**Developmental/Operational Status of Aviation Weather Programs/Projects**

Lead Agency/Institution	Under Development	Completed or Operational	Total
Department of Defense	16	23	39
Department of Transportation Federal Aviation Administration	21	24	45
National Aeronautics and Space Administration	10	5	15
Department of Commerce National Oceanic and Atmospheric Administration	11	8	19
Industry, University, and Association Partners	5	16	21
<b>TOTAL</b>	<b>63</b>	<b>76</b>	<b>139</b>

Programs/Projects under Development



All Programs/Projects



## HIGHLIGHTS OF RECENT RESULTS AND UPCOMING MILESTONES

When the OFCM began compiling a database of programs and projects that support the national aviation weather initiatives, a major objective was simply to identify and obtain current information about the many activities in progress, recently completed, or planned for initiation in the next year or two. Although additional new starts can be expected each year, it will become increasingly valuable to track completions, achievements, and most important, successful transitions of technology and program results into the operations of the aviation community. For this fiscal year (FY) 2004 update, the OFCM staff has selected some recent successes to highlight and some important upcoming milestones in moving products and results into operations.

This review is selective and partial, but it provides an informative cross section of what has happened during the past year in aviation weather research and what we can expect in the near future. The first mention of a program or project is in **boldface**. The corresponding fact sheet page in Appendix A is cited in square brackets after the name.

### *Federal Aviation Administration (FAA)*

Among the many programs being led by the FAA in the Department of Transportation, the **Forecast Icing Potential (FIP)** product became operational in March 2004 [FAA-5A]. The FIP product is now available to the general aviation community, along with the **Current Icing Potential (CIP)** product, on the **Aviation Digital Data Service (ADDS)** website [FAA-5, FAA-4]. During the first quarter of FY 2005, a decision will be made on experimental use of the FIP Alaska product and on operational use of the higher-resolution 20 km CIP. (The CIP product first became operational in March 2002. The ADDS website became operational in September 2003.)

FAA's **Graphical Turbulence Guidance (GTG)** product for flight level 200 and higher (GTG FL200+) became operational in March 2003 for meteorologists and dispatchers [FAA-7]. An operational decision on the GTG product for FL 100-200 is scheduled for the first quarter of FY 2005. GTG FL210+ is available on the ADDS website. Readers of the *Mid-Course Assessment* report will recall that the GTG was highlighted as a key technology to reduce in-flight turbulence risks.

The **Terminal Convective Weather Forecast (TCWF)** product is an automated, one-hour graphical forecast of convection intended for use by FAA traffic managers in terminal areas with high traffic density [FAA-10]. It has now been successfully tested at Dallas/Ft. Worth, Orlando, New York, and Memphis airports. In FY 2006, TCWF will be installed at operational Integrated Terminal Weather System (ITWS) sites. The **Terminal Ceiling and Visibility (TCV)** product, which provides automated forecasts for airports with chronic low ceiling and visibility risks, had its test bed trial in New York City airports in FY 2004 [FAA-36].

The **Water Vapor Sensing System (WVSS)** is a sensor system that automatically makes in situ water vapor observations from commercial aircraft on which it is installed and downlinks the data for use by weather forecasters [FAA-12]. The WVSS became

operational in May 2004, and transfer of the technology to NOAA is scheduled to be completed in FY 2005.

### ***National Aeronautics and Space Administration (NASA)***

During the first quarter of FY 2004, NASA's **Synthetic Vision System (SVS)** had its initial flight evaluation for air transport [NASA-6]. For this evaluation, SVS display concepts were integrated with concepts to prevent runway incursions. During FY 2005, the **Terminal Prediction and Warning Systems (TPAWS)** project will be undertaking in-service evaluations of its Enhanced Turbulence Radar and the **Turbulence AutoPIREPS System (TAPS)** [NASA-7].

In NASA's **Weather Information Communications [WINCOMM]** project, the next-generation weather datalink technology had its initial lab evaluation during the fourth quarter of FY 2004 [NASA-8]. A flight evaluation of this datalink technology is scheduled for the third quarter of FY 2005.

### ***National Oceanic and Atmospheric Administration (NOAA)***

The **Weather Research and Forecasting (WRF)** mesoscale modeling activity is a consortium effort led by NOAA with support from other agencies and academia [NOAA-9]. WRF models continue to move into operational use in various applications, some of which have direct and significant impact on improving aviation forecasts. During 2004, a WRF version became operational at NOAA's National Centers for Environmental Prediction (NCEP) and the Forecast Systems Laboratory. A WRF model will become operational at the Air Force Weather Agency in FY 2005. Implementation of a WRF model in the NCEP High Resolution Window began in October 2004.

**Integrated Radar Data Services (IRaDS)** began operations in August 2004 [NOAA-10]. IRaDS is a collaborative effort to concentrate and transmit high-resolution weather radar data at cost for use by the private sector, government agencies, and researchers.

Development of the **Prototype Aviation Collaborative Effort (PACE)** will continue with additional evaluations in the spring of 2005 for the Tactical Convective Hazard Product and Crosswind Tactical Decision Aid [NOAA-12]. The plan for this suite of products tailored for the needs of an Air Route Traffic Control Center includes icing, turbulence, and ceiling and visibility products.

As emphasized in Section 4 of the *Mid-Course Assessment*, NOAA is collaborating with the aviation community on weather training for general aviation pilots. The weather-related accident data for general aviation, discussed in the next section, underscore the importance of these efforts for reducing weather-related accidents. The **Pilot Training Initiative (PTI)**, a collaboration with the Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation and Meteorologix, will provide live seminars nationwide in most U.S. cities during FY 2005 [NOAA-13]. The PTI targets the general aviation community

and Certified Flight Instructors. Another important part of the overall education and training for technology transfer, NOAA's **Aviation Operations Course** for National Weather Service aviation forecasters, became operational in November 2004.

## **WEATHER HAZARD ACCIDENT TRENDS**

The following discussion of trends in weather-related accidents extends the analysis presented in the *National Aviation Weather Program Mid-Course Assessment* (OFCM 2003b) with the final NTSB data for accidents that occurred in 2002. Preliminary NTSB data for 2003 are considered in some of the discussion about weather factors within a weather hazard category. However, the 2003 data are still too preliminary to use in calculating accident trends by the least squares regression method defined in the *Mid-Course Assessment*. Appendix C explains how the 80 percent reduction goals for 2006 originated. Appendix D contains the tabulated data and a set of graphs, comparable to those used in the *Mid-Course Assessment*.

Appendix C includes descriptions of the three aviation regulatory categories used by the NTSB and the FAA and adopted as well for the *Mid-Course Assessment*. Stated broadly, flights of aircraft capable of carrying 10 or more passengers by a common carrier (that is, a commercial airline) are regulated under Part 121 of the Federal Aviation Regulations. Part 91 covers all noncommercial and nonmilitary aviation. Revenue-generating flights not covered under Part 121, including scheduled passenger service in aircraft with fewer than 10 seats and nonscheduled passenger and cargo service, are covered by Part 135.

### ***Part 91, General Aviation***

The fatal accident rates for Part 91 accidents from all causes and for weather-related accidents increased in 2002 relative to 2001. However, the trend since 1996 for weather-related fatal accidents still achieves the 2006 goal of 0.08 or fewer accidents per 100,000 flight hours. The total weather-related accident rate also increased to the highest level (1.35 per 100,000 flight hours) since the 1998 rate of 1.43 per 100,000 flight hours.

- When the data are analyzed by weather hazard categories, the 2002 rates continued on a downward trend for precipitation (non-icing hazards)
- For the following categories, 2002 rates are higher than in 2001, but a satisfactory downward trend (achieving an 80 percent reduction by 2006) is still intact:
  - Restricted visibility and ceiling hazards
  - Icing hazards (particularly strong increase in 2002 over recent years)
  - En route and terminal winds.
- For **turbulence and convection** hazards, a small increase in *fatal* accidents leaves the trend on track to meet the 2006 goal. However, a larger relative increase for *total* accidents with turbulence or convection hazards cited as a factor has shifted that trend above its 2006 goal (0.29 versus 0.15 accidents per 100,000 flight hours).

- For **temperature and lift hazards**, there were increases in 2002 much above the previous trend for both fatal and total weather-related accident rates. Neither trend would now meet an 80% reduction goal by 2006. The increases in both total and fatal accidents were entirely due to **high density altitude**, a hazard that was called out for attention in the *Mid-Course Assessment*.

The 2003 Nall Report on accident trends and factors in the general aviation community, prepared and published by the AOPA Air Safety Foundation, found that visual flight rule (VFR) flight into instrument meteorological conditions (IMC) resulted in the greatest number of fatal weather accidents for the general aviation categories it covers (Air Safety Foundation 2004).<sup>1</sup> In the Appendix D analyses for Part 91, the Restricted Visibility and Ceiling Hazards category illustrates this problem. Of 67 total weather-related accidents, 50 involved fatalities (75 percent), by far the highest percentage among the categories analyzed. These 50 fatalities represent 68 percent of the weather-related fatalities in all of Part 91. The hazard categories of Precipitation, Icing Conditions, and Temperature and Lift Hazards also had relatively high proportions of fatal accidents. For these weather-related factors, pilot education and training can make a major difference in how the general aviation pilot responds to the hazard.

### ***Part 121, Larger Commercial Carriers***

Again in 2002, there were no fatal weather-related accidents involving Part 121 aircraft. The rate per 100,000 departures for all weather-related accidents continued to decrease. As was highlighted in the *Mid-Course Assessment*, **turbulence and convection hazards** continue to dominate the weather hazards cited in Part 121 accidents. Of the nine weather-related accidents in 2002 involving Part 121 aircraft, seven involved turbulence and convection hazards. In the preliminary data for 2003, 11 of 12 weather-related accidents are in this category.

### ***Part 135, Small Scheduled Passenger Service and Nonscheduled Commercial Flights***

The total weather-related accident rate for Part 135 aviation decreased in 2002, shifting the trend from an upward to a downward slope. The fatal accident rate and the trend were little changed from last year's analysis in the *Mid-Course Assessment*.

The hazard category trends observed in the *Mid-Course Assessment* continued with little change for:

- Restricted visibility and ceiling hazards
- Precipitation (non-icing) hazards

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<sup>1</sup> The annual Nall Report uses NTSB data on aviation accidents during the preceding year. The definition of general aviation aircraft used in the Nall Reports overlaps substantially, but is not identical to, the definition used in this report, which covers flights regulated under 14 CFR 91 (see Appendix C). Nevertheless, the detailed analysis of the accident data performed by the Air Safety Foundation staff provides valuable insights into the statistical trends seen in the NTSB data for weather-related accidents.

- Icing conditions
- Turbulence and convective hazards
- En route and terminal winds.

For *temperature and lift hazards*, a second year in a row with no accidents has shifted the trend from an upward to a downward slope. If this trend is sustained, the projected 2006 fatal accident rate will achieve the 80 percent reduction goal for this hazard category.

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## **Appendix A: Program/Project Fact Sheets**