ADM and judgment, rather than relying on pilots to adopt these practices intuitively or relying completely on their experience. Much of this research is based on accident investigations that indicate that decision making processes contributed to or caused the accident. The FAA believes that pilots in the future will benefit from accident analysis and training methodologies designed to overcome lapses in judgment.

29. Aeronautical Decision Making and Judgment Training

The training manual ''Aeronautical Decision Making for Student and Private Pilots," prepared by the AOPA Air Safety Foundation for the FAA (Report No. DOT/FAA/PM-86/41), divides pilot activities into three basic categories. First are procedural activities, including management of the powerplant, fuel, navigation, communications, and other aspects of aircraft configuration. The second category is perceptual and motor activities, including aircraft control, and geographic orientation. The third category is decision making activities. The training manual covers self assessments of skill, knowledge, physical and psychological capabilities, hazard assessment, navigation planning, and flight priority assessment. The FAA has determined that aeronautical decision making is necessary, because flying involves a continuous stream of decisions about the crew, aircraft, environment, and operation. These decisions include pre-flight, "go/no-go" decisions, and in-flight decisions, which are designed to neutralize (by eliminating or reducing) risks in flight.

Of the three pilot activity categories, decision making accounted for 51.6 percent of fatal accidents in an analysis of data for a 5-year period, according to the AOPA manual. The objective of the manual, and aeronautical decision making (ADM) and judgment training in general, is to teach pilots to avoid situations that require luck or skill beyond their capabilities, and to reduce the level of judgment-related accidents.

With a solid base of conventional skills and knowledge, aeronautical decision making and judgment training can provide a structured approach to pilot reaction to event changes in flight. This training can be especially valuable to pilots with less experience to help confront the unexpected. These "event changes," in addition to preflight decisions, may include mechanical problems, new instructions from Air Traffic Control, or unexpected weather. These changes call for decisions in which poor judgment may entail a high degree of risk. A common example of the target of such training is the noninstrument-rated private pilot who either fails to obtain a complete weather briefing or unexpectedly encounters poor weather but nevertheless is inclined to continue a flight into instrument meteorological conditions.

Aeronautical decision making and judgment training follow a threepronged approach:

• Provide an analytical method for making decisions and evaluating risks.

 Address pilots' hazardous attitudes and substitute attitudes that promote good judgment.

• Address the need to overcome high stress, which reduces judgment and decision-making abilities.

Under the proposal, the requirement for ADM and judgment training would be placed under the knowledge requirements for all pilot certificate levels and all instrument ratings in proposed parts 61 and 141. The aviation community is directed to existing FAAsponsored guidance material as well as additional educational materials available from other sources. Furthermore, the FAA plans to issue an advisory circular that will address the essential elements of ADM and judgment training that pertain to the various certificate levels.

30. Windshear Avoidance

The FAA believes that understanding windshear would enhance safety for general aviation pilots and, therefore, proposes to require ground training on windshear for all pilot certificate levels and the instrument rating. This proposal is based on the increased information available on windshear and industry expert opinion obtained through the FAA Pilot and Flight Instructor JTA, in which windshear is listed as a critical area of pilot knowledge.

The proposal would add a knowledge requirement on windshear avoidance to the current requirements on recognition of critical weather situations and the proposed aeronautical knowledge areas for an instrument rating, a recreational, private, commercial, and an ATP certificate. In the commercial pilot requirements of § 61.125, "airplanes," the windshear knowledge requirement would be added as part of a new meteorology knowledge requirement because this paragraph, unlike the paragraphs relating to rotorcraft, gliders, airships, and balloons, currently does not mention meteorology or weather as a knowledge requirement. The aviation industry's awareness of the importance of the windshear phenomenon and its understanding of the problem has increased markedly in recent years. A National Research Council (NRC) study

stated that windshear is "an infrequent but highly significant hazard to aircraft landing or taking off," ¹ and recommended a series of measures to reduce windshear accidents.

As a result of the study and the Council's recommendations, the FAA sponsored the development of a comprehensive Windshear Training Aid. Advisory Circular 00-54, "Pilot Windshear Guide," constitutes one section of the two-volume Windshear Training Aid and was issued on November 25, 1988. In addition, the FAA has implemented and expanded ground and flight training requirements for flightcrew members employed in parts 121 and 135 air carrier and commercial operations. In air carrier operations, the FAA pursues a "systems concept" that includes an improved low-altitude windshear weather forecasting technique, ground-based windshear detection equipment, airborne windshear detection equipment, and improved pilot training.

The NRC report stressed, however, that all classes of pilots should understand the windshear phenomenon, including general aviation pilots. The report noted that general aviation pilots usually are not as well trained as air transport pilots and that they rarely have access to advanced training simulators. According to the report, "the most practical and immediate solution appears to be an extensive education program to warn general aviation pilots of the hazards associated with low altitude windshear and to teach both avoidance and escape procedures."² In the report, NRC stated that the risk posed by windshear can be reduced 'very soon by an education campaign directed at all classes of pilots." ³ The lack of awareness regarding windshear-including the origins, nature, and potential hazards of downbursts and wind variability-was found to be most acute within the general aviation community because of the diverse pilot skill and training levels. The report also stressed the need for standardized terminology for pilotcontroller transmissions on windshear conditions and reports.

NTSB statistics indicate that general aviation has an average of 16 windshearrelated accidents per year based on figures for 1979 through 1988. Those 16 accidents, including 1.3 fatal accidents, have resulted in an average of 3.8 fatalities and 4.4 serious injuries related

¹United States. National Research Council. Low-Altitude Wind Shear and Its Hazard to Aviation. Washington: National Academy Press, 1983. Page 1.

²Ibid., p. 1.

³Ibid., p. iii.