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PILOT JUDGMENT: CURRENT DEVELOPMENTS IN EVALUATION AND TRAINING AND FUTURE ISSUES IN AVIATION CASES

Michael J. Pangia*

Review of probable cause determinations of the National Transportation Safety Board (NTSB) reveals that a vast number of aviation accidents result from errors or failures in the exercise of pilot judgment.¹ The exercise of good pilot judgment is neither taught nor evaluated in any primary flight training curriculum presently used. This article emphasizes the need to probe deeper into the judgment process in order to learn how to reduce recurrences of these accidents through different approaches in training techniques. It also presents a brief account of the development in this area and predicts possible future effects in the development of aviation law.

At 8:08 a.m. on March 6, 1971, a dental surgeon with a pri-
vate pilot certificate and an instrument rating took-off in a six-place Beechcraft Bonanza aircraft bound for Harrison, Arkansas, seventy miles away. Prior to the flight, the surgeon-pilot visited the Flight Service Station (FSS) where he was informed of a close temperature and dewpoint, 36 and 35 degrees respectively, with light rain and fog. The pilot was also told that an area forecast indicated the passage of a cold front with some icing conditions and that a pilot who had taken off approximately a half an hour before had reported picking up ice below 7,000 feet. Although the surgeon-pilot originally filed a flight plan that indicated a cruising altitude of 5,000 feet, when he heard of the icing report, he changed it to 7,000 feet. The FSS personnel commented that it was "probably better at seven," to which the pilot responded "no, change it back to five."

At the urging of the FSS personnel, the pilot sat in the aircraft until the 8:00 a.m. hourly weather report for his destination airport was available. That report contained the same close temperature and dewpoint, light rain, low ceilings, and a notation, "PRESRR" (pressure rising rapidly), which indicated that the cold front was at the destination airport. Such conditions are dangerous because of, among other possibilities, the formation of structural ice, particularly clear ice. After take-off, the pilot complained of icing, but the air traffic controllers were unable to do anything except respond to his

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* The details of this account are contained in Deal v. United States, 413 F. Supp. 630 (W.D. Ark. 1976), aff'd, 552 F.2d 255 (8th Cir.), cert. denied, 434 U.S. 890 (1977) (tried for the United States by this author), and in NTSB ACCIDENT REP. No. FTW-71-A-F057 (March 12, 1971).

* A spread of 4 degrees Fahrenheit or less between the temperature and dewpoint indicates the likelihood of the existence of fog, precipitation, or other visibility obscuring phenomena. See generally FAA ADVISORY CIR. 61-25B, at 118 (1980).

* 413 F. Supp. at 634.

* Id.

* Clear ice occurs when large supercooled droplets of water in sub-freezing ambient temperatures refrigerate on the aircraft surface. In a cold front, cooler air moves in and replaces relatively warm air by plowing under it. Near the transition of the two air masses, an aircraft approaching from the cold side may encounter rain falling from the warmer side which literally refrigerates on its surfaces. Depending upon the temperature and the size of the water droplets, the accumulation of clear ice can be alarmingly rapid. See FAA ADVISORY CIR. No. 00-6A, at 99-101 (1975).
request for changes of altitude. The pilot arrived at his destination, but while turning onto the final approach course, he apparently became preoccupied with maintaining visual contact with the runway and banked the aircraft too steeply at too low an airspeed, stalled, and crashed just short of the runway. One-half to three-quarters of an inch of clear ice was found on the airframe and in broken sheets under the wreckage. The pilot and his passengers died in the crash.

Several months after the accident, the NTSB determined that the probable causes of the accident related to the pilot-in-command who, among other things, made "improper in-flight decisions or planning" and "failed to obtain/maintain flying speed," which is essentially pilot error with an "incorrect weather forecast" as a factor. In a report prepared by the Flight Safety Foundation (Foundation), the accident was classified as being caused by "too much weather." The Foundation recommended "upgrading the FAA Flight Service Stations" to provide better information to the pilot. The estate of the pilot and the families of the passengers sued the United States for alleged negligent air traffic control service in *Deal v. United States*. The court found the sole proximate cause of the accident to be pilot error. The pilot simply exercised poor judgment.

A review of statistics reveals that accidents involving poor
The current approach of merely teaching aerodynamics, meteorology, and navigational concepts to pilots appears largely ineffective in reducing accidents. Certainly, government and private aviation publications are replete with advice and warnings to pilots about proper airspeed, weather, fuel requirements, the use of charts, and nearly every aspect of flight safety. Nevertheless, a comparison of NTSB annual reports indicates an undiminished percentage of accidents occurring from the exercise of poor judgment on the part of pilots. For example, a recent NTSB release observed that some pilots "continue to show a recurring violation of a basic rule of flight—failure to maintain flying speed." In that release, the NTSB cited as a typical profile, a pilot making a steep bank at a low altitude. Further, the NTSB stated that "[t]he pre-

16 See supra note 1 and accompanying text.
17 FAA ADVISORY CIR. No. 61-23B (1980) also contains such information. Many other publications of this nature exist, but are too numerous for specific mention.
18 See supra note 1 and accompanying text. See also Lucaccini, Situational Emergency Training Experiences and Implications (1982) (proceedings of the SAE Aerospace Congress & Exposition, Anaheim, California, Oct. 25-28, 1982). Lucaccini notes that the NTSB 1977 review of data showed not only that the "pilot" was the factor in 81% of the total civilian accidents for that year, but also that the trend of pilot error in the military has not significantly changed over the past decade. Id.
20 Id. A bank increases the speed at which an aircraft will stall. If a pilot banks too steeply while turning onto the final approach course for a landing, the aircraft may stall and spin at an altitude which affords no room for a safe recovery. FAA ADVISORY CIR. No. 61-23B, at 24-27 (1980).
vent this type of accident," pilots must keep in mind the need to maintain sufficient airspeed no matter what the distraction.\textsuperscript{21} The release demonstrates that statistics do not show a decrease in the prevention of pilot-error accidents as a result of these repeated warnings. Obviously, until the cause of poor judgment is discovered and analyzed in terms of increasing self-awareness, the percentage of accidents attributable to human error will remain high.\textsuperscript{22}

Basically the pilot in the \textit{Deal} case exercised poor judgment, a common manifestation of human error leading to fatal decisions. By trying the cases like \textit{Deal}, particularly from the damages aspect, an attorney can learn the pilot's background, habits, family life, mental health, and many other factors that have a bearing on the pilot's judgment process. While an in-depth analysis of the psychological reasons for the exercise of poor judgment is generally unnecessary for the determination of accident cause in the legal sense, ignoring evidence that may lead the way to more insight into the manner in which poor judgments are made, would only perpetuate the tragedy of these accidents. One lesson to be learned from \textit{Deal} is the recognition that to reduce the recurrence of these accidents, an answer must be found to the fundamental but often ignored question which has been appropriately termed, "the real why" of the human error accident.\textsuperscript{23} This question must be answered in order to understand why pilots make good and


\textsuperscript{22} Peelle, \textit{Psychological Factors Relating to Safety Training: Content and Methodology}, 11 SAFE J. 12 (1981), appropriately states that:

It appears that human factors are some of the more significant ones, and, in fact, the critical common denominators in a variety of accidents. Yet, approaches to improving safety have not typically addressed these factors. The focus, instead, has usually been on things such as technical information, equipment, manuals or procedures which, unfortunately, do not necessarily fit all contingencies. These approaches have not reduced problems of safety.

Peelle further notes that "[w]e lack, in short, understanding of the microstructure of human behavior in the aviation environment, and thus an understanding of the causes of human errors in that environment." \textit{Id.} at 12.

bad judgments.

Judgment has been defined as "the forming of an opinion ... as from circumstances presented to the mind" or "capacity to make reasonable decisions ..." The outcome of judgment is the decision to act based upon events commanding the decision rather than a reaction to those events. Pilot judgment has been defined recently as "the mental process by which the pilot recognizes, analyzes, and evaluates information regarding himself, the aircraft, and the outside environment" and that "[t]he final step in the process is the making of a decision pertaining to the operation of the aircraft." The study of pilot judgment is embodied within the broad subject of aviation psychology, recently defined as "the science of human behavior in the operation of aviation systems." Aviation psychology examines pilot performance in a broad sense. For example, it recognizes that accidents result when the machine, in this case the aircraft, fails to interface with the normal physiological, sensory, and perceptual limitations of the human being—the so-called "induced pilot error" accident. Similarly, human errors can occur in emergency situations because of inappropriate responses due to stress.

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27 S. Rosco, AVIATION PSYCHOLOGY 3 (1980). Unfortunately, the term "psychology" often conjures visions in the mind of the general public of a psychiatrist's couch. In fact, Rosco states, "[w]hen someone asks me what I do and I say that I'm an aviation psychologist, almost invariably they ask me if that means that I psychoanalyze pilots." Kearsley, Aviation Psychology, APA MONITOR, Aug./Sept. 1981, at 10. The term as used herein in connection with aviation connotes a broad study of human behavior, an important field that may be in search of a less threatening title. See AIRCRAFT DESIGN INDUCED PILOT ERROR, NTSB RELEASE No. PB.175 629 (July 1967) (explaining that certain cockpit and instrument design features may tend to increase the probability of a mistake).
28 Lucaccini states that "[i]t would appear that aircraft emergencies are among the ultimate stressors for flying personnel and that the element of threat of personal risk is the critical factor that underlies the human operator's decision errors that are involved in some aircraft accidents." Lucaccini, supra note 18, at 4. Lucaccini further notes that human behavior in response to extreme factors may be categorized by a sharp increase in excitability expressed in impulsive acts, impairment and loss of skills or by an inhibition and even the cessation of activity, and that both types of
An inappropriate reaction can be particularly acute if the pilot lacks experience in stressful situations. Pilots with thousands of flying hours have made emergency landings because of engine failures, merely because the pilots had forgotten to switch from empty to full fuel tanks. This occurrence may be an example of mental rigidity in the unusual situation that may not be always corrected, and perhaps even aggravated, by extensive flying experience.

Regarding the “induced pilot error” accident, cockpits must be designed to accommodate expected habits, perceptions, and reactions of the human being in order to minimize the possibility of mistakes. Pertaining to emergency situations, inbreeding proper responses has been done to some extent in primary training and is being done with increasing frequency in simulators. Nevertheless, most human error accidents probably are caused by pilots who ordinarily are not the careless or reckless type. Interestingly, pilots that are responsible and ordinarily careful persons who have had plenty of time to select safe alternative courses of action still exercise poor judgment. It is the judgment process itself that must be examined before evaluation in training techniques can be adopted.

reactions result in a disorganization of rational activity on the part of the individual. Id. at 4.


31 Mental rigidity may be a manifestation of what one behavioral study has called an “interruption” which overrides an ongoing sequence, drawing a person’s behavior or thoughts to some other locus. The more established the pattern, the greater may be the stress caused by the unusual and unexpected situation. This technique is also used in hypnosis. See generally I R. Dilts, J. Grinder, R. Bandler, L. Bandler, & J. DeLozier, Neuro-linguistic Programming: The Study of the Structure of Subjective Experience 236-40 (1980).


33 An interesting approach to the problem of panic situations is taken by the Air Force in its F-15 training. See AIR FORCE SYSTEMS COMMAND, REPORT NO. AFHRL-TR-76-47(1), SITUATIONAL EMERGENCY TRAINING (June 1976) (Brooks Air Force Base, Texas).
Fundamentally, the seemingly traditional supposition that judgment neither can be tested nor taught must be discarded to allow exploration of new approaches to modify positively the exercise of judgment. The cliche which probably every pilot has heard at one time or another, that "you either have it or you don't," not only ignores the advances which have been made in obtaining positive behavioral modification in many areas of human endeavor ranging from child psychology to personnel management, sales training, negotiating and even in many legal fields, but also bespeaks of an attitude which inhibits progress in a very important area of accident prevention. The aviation population can no longer afford to consider itself impervious to education and positive change in the exercise of judgment. Fortunately, significant advances in this area are now appearing.

The concern about pilot judgment and judgment modification began during World War I when a psychologist, Robert Yerkes, undertook the development of tests to weed out undesirable pilot candidates. In World War II, the Army-Air Force established an aviation psychology program which initially focused on pilot selection and classification, but the program soon expanded to encompass other areas such as pilot training and performance. In 1947, both the Civil Aeronau-

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1 See, e.g., A. Zeller, USAF Multimedia Traffic Training Program (Oct. 11, 1973), (presented at the First International Conference on Driver Behavior, Zurich, Switzerland) wherein empirical validation is noted for accident rate reduction as a result of driver judgment and behavioral training by the United States Air Force.


3 Id.

4 Kearsley, supra note 27, at 10.

5 Id. The War Time Programs gave rise to a number of psychologists, the most
tics Board and the Department of Commerce advocated that psychological testing developed by the military during World War II should determine the fitness of commercial pilots, but no plan was adopted. This author's opinion is that the state of the art has not advanced sufficiently to provide an objective judgment testing program to eliminate applicants. At the current time, however, the knowledge necessary to educate and to train pilots to develop a greater self-awareness in judgment-making is available and must be used to reduce accidents.

To effectively explore the judgment process it is necessary, as a leading psychologist states, "[t]o find the correlates of the factors which do not depend upon specific training or experience—in other words, the culture-free characteristics of people that lead to good judgment." Further, educating pilots as to how their minds work in the selection and assessment of the information that goes into making judgments is necessary so that pilots can positively modify the process and more objectively control their decisions. This education is basically a specialized study in self-awareness, the need for which has been long recognized but apparently little satisfied.

The first broad based attempt to study judgment training notable of which was Paul FITS, who concentrated primarily on the human aspects of systems engineering—the capabilities and limitations of humans to interface with mechanical controls and instruments.


Interestingly, the Airline War Training Institute in 1943 instructed crews in the following manner:

Gnothi Seauton. These two words represent the foundation of philosophy. If they are Greek to you, that's all right because they are the words of the ancient Greek philosopher, Socrates. They mean "Know Thyself", your abilities, personality, and character. This philosophy is extremely important to flight crews who must know themselves, particularly their limitations, in order to act efficiently, behave properly and work as a team to fly safely. Do you know yourself?

AIRLINE WAR TRAINING INSTITUTE, ATTITUDE 3 (1943). See also D. BEATY, THE HUMAN FACTOR IN AIRCRAFT ACCIDENTS 10 (1969), noting that "[p]sychologists have only just started to be interested in decision theory, and considering effective decision-making is a biological, sociological and economic need for our survival. There is little evidence that students in our schools and universities are adequately instructed in evaluative abilities."

Kearsley, supra, note 27, at 11 (quoting aviation psychologist Stanley Roscoe).

did not occur until 1977 under a program sponsored by the Federal Aviation Administration (FAA) entitled, JUDGMENT EVALUATION AND INSTRUCTION IN CIVIL PILOT TRAINING, undertaken by R. Jensen and R. Benel. This study attempted to define judgment and explore whether it can be evaluated and taught. It noted that every decision that a pilot makes is influenced by physiological and social pressures that are virtually impossible to measure at the time a pilot's decision is made. In addition, a person's self-image and the need to maintain an external image largely determine how a pilot's values will affect his judgment process. The study concluded that judgment can be evaluated and taught and defined in two component parts as follows:

(1) The ability to search for and establish the relevance of all available information regarding a situation, to specify the alternative courses of action, and to determine expected outcomes from each alternative.

(2) The motivation to choose and authoritatively execute a suitable course of action within the time frame permitted by the situation.

The JENSEN AND BENEL STUDY further notes an existing suggestion that because of the nature of the subject matter to be taught, attitudes, principles, and motivations, the flight instructors should bear the primary load of judgment training. Interestingly, the FAA seems to have recognized the feasibility of teaching judgment, at least on the flight instructor level, indicated by the publication of a circular entitled the Flight Instructor's Handbook. This handbook attempts to teach the flight instructor the fundamentals of human behavior and also stresses the importance of imparting positive attitudes.

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41 Id. at 8
42 Id.
43 Id. at 55.
44 See FAA ADVISORY CIR. No. 61-16A (rev. 1969), which has been superseded by FAA ADVISORY CIR. No. 60-14, Aviation Instructor's Handbook (1977) [hereinafter cited as FAA HANDBOOK].
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and motivations while instructing. However, there is no identifiable curriculum or study material from which the student pilot can learn directly about the judgment process. Apparently, efforts in this regard are now being made.

The latest and perhaps first valid attempt to design a judgment evaluation and teaching method in primary pilot training is a program undertaken at the Embry-Riddle Aeronautical University and sponsored by the FAA, entitled DEVELOPING A CIVIL AVIATION PILOT JUDGMENT TRAINING AND EVALUATION MANUAL. The summary of this effort now appears in three volumes entitled, PILOT JUDGMENT TRAINING AND EVALUATION. Volume I contains a technical summary of the findings regarding the judgment process of pilots verified by observations and experimentation of various training techniques. Volume II is a Student Manual which attempts to explain directly to the student the processes of good and bad judgment and contains a test by which a student can identify his or her particular judgment traits. Volume III is an Instructor's Manual which is designed to redirect a pilot's thinking in order to promote the consistent use of good judgment. While these manuals are being still evaluated, they represent a major step forward to positively modify the judgment process of pilots, and reduce the occurrence of accidents caused by poor pilot judgment. They also contain some very interesting observations.

The EMBRY-RIDDLE STUDY recognizes that most accidents result from a combination of untoward circumstances, rather than a single cause such as pilot error, aircraft defect, or envi-

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48 FA A Handbook, supra note 47, at i.
49 A pilot education program, entitled Command/Leadership/Resource Management, available through United Airlines, Inc., is designed to make pilots self-aware of some of their behavioral traits, particularly in cockpit management. However, there is no such program available for primary students.
51 J. BERLIN, PILOT JUDGMENT TRAINING AND EVALUATION (1980) (Embry-Riddle Aeronautical University, DOT/FAA/CT-82/56) (available through the National Technical Information Service, Springfield, Virginia) [hereinafter cited as EMBRY-RIDDLE STUDY].
vironmental stress, and that an aircraft accident is the end result of a causal chain of these circumstances.\textsuperscript{52} The EMBRY-RIDDLE STUDY states that in a similar manner, most accidents do not result from one error in judgment, but from a series of errors pertaining to pilot proficiency and experience, aircraft condition, or stress caused by the outside environment forming a "poor judgment chain," the principles of which follow:

1. One poor judgment increases the probability that another poor judgment will follow.
2. The more poor judgments made in sequence, the more probable that others will follow.
3. As the chain of poor judgment grows, the alternatives for safe flight decrease.
4. The longer the pilot judgment chain becomes the more probable that an accident will occur.\textsuperscript{58}

The EMBRY-RIDDLE STUDY further stresses that if a pilot does not take the most important first step in breaking the chain, which is a recognition by the pilot that he or she has made a poor judgment, there is little chance to prevent subsequent recurrences of poor judgments.\textsuperscript{54} That recognition requires a self-evaluation and provision of corrective information about his or her judgment process—a feedback system. As further noted, "good judgment is a learned process" and with appropriate training, a pilot will learn to obtain feedback from his or her own senses.\textsuperscript{55} To break the poor judgment chain as early as possible, the pilot must (1) recognize that a poor judgment has been made; (2) check for personal stress that could allow the chain to continue; (3) correct the problem that resulted from poor judgment; (4) search for other poor judgments; and, (5) diagnose the original poor judgment to provide oneself the feedback to avoid making a similar poor judgment in the future.\textsuperscript{56}

The EMBRY-RIDDLE STUDY further recognizes the necessity

\textsuperscript{52} EMBRY-RIDDLE STUDY, supra note 51, at 6.
\textsuperscript{53} Id. at 6-7.
\textsuperscript{54} Id. at 7.
\textsuperscript{55} Id. at 3.
\textsuperscript{56} Id. at 7-8. (emphasis supplied).
of identifying specific thought patterns that would make a pilot willing to violate regulations, extend safety margins, exceed legal limitations, or attempt to operate an aircraft in conditions beyond his or her capabilities, or what the JENSON & BENEL STUDY labels as “irrational pilot judgment.” The JENSON & BENEL STUDY postulated that if these thought patterns could be indentified, then pilots could be trained to recognize them in their own thinking and apply corrective actions. In consultations with experts in psychological and social sciences, the EMBRY-RIDDLE STUDY identified the following hazardous thought patterns:

1. **Anti-authority**—a thought pattern found in people who resent the control of their actions by any outside authority. These people will tend to ignore advice even though well-founded.
2. **Impulsivity**—a thought pattern found in people who, when facing a moment of decision, feel that they must do something and do it quickly. They tend to react to the first thing that comes to mind without examining alternatives.
3. **Invulnerability**—a thought pattern exhibited by people who feel that nothing disastrous will happen to them. These people are more likely to take chances and unwise risks, feeling that accidents will happen to other people, but not to them.
4. **Macho**—a thought pattern exhibited by people who are always trying to prove that they are better than others. A person with this thought pattern generally exhibits overconfidence and attempts to accomplish too difficult things in order to prove himself or herself and gain the admiration of others. This characteristic, of course, is not restricted to males.

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87 Id. at 10; JENSEN & BENEL STUDY, supra note 43, at 3-4.
88 EMBRY-RIDDLE STUDY, supra note 51, at 9-10.
89 In fact, one collection of pilots' personality profiles indicated a significantly higher degree of achievement, exhibition, dominance, change, and heterosexual in females than in comparison to their average male counterparts. The average profile is characterized by what popularly is conceived as the adventurous, romantic, "he-man" figure—definitely a pilot who projects self-confidence. The average profile of the female pilot is characterized by the same factors as the male profile. In other words, it was found that female pilots have more personality traits in common with male pilots than they have with women in the United States’ population at large. Novello & Zakhour, Psycho-social Studies in General Aviation (II)—Personality Profile of Male Pilots, 45 AEROSPACE MEDICINE 185 (1974); Novello & Youssef, Psycho-Social Studies
5. *External control*—a thought pattern exhibited by people who feel that they can do very little, if anything, to control what happens to them in life. They often exhibit this belief pattern by blaming others or outside events for what happens to them and tend to leave decision-making responsibility to others.

In addition to the self-awareness of the presence of hazardous thinking, the *Embry-Riddle Study* emphasizes a pilot's need to be taught to take corrective actions against hazardous thought patterns. Some promising training materials are proposed to teach students to remove the effect of hazardous thought patterns by substituting it with a good judgment thought pattern. The substitution follows the tenet of behavior modification that a change of thoughts will promote a change in actions. Hopefully, the FAA will apply this work by introducing these concepts into its primary training requirements.

The National Transportation Safety Board (NTSB), along with determining probable causes of accidents, formulates safety recommendations in an attempt to reduce the recurrence of accidents. The NTSB recognizes the need to examine a pilot's judgment process in accident investigations in order to reduce the accident rate. However, the NTSB's ap-
proach on this subject of accident investigations has been sporadic and uncertain.

The NTSB finally acted on its recognition of the need to probe more deeply into the psychophysiological aspects of judgment errors in 1979. That year, the NTSB investigated the Downeast Airlines accident in Rockland, Maine, which occurred on May 30th 1979. The NTSB report which was released in 1980 was probably the first public report containing investigations of a crew's physiological and psychological conditions just prior to an accident. Interviews with former company pilots, friends, and relatives indicated that the captain, who was not an assertive person, was subject to constant company pressure. Interviews also revealed high pilot turnover in the company. For the captain the stress manifested itself by a loss of appetite, exhaustion, preoccupation, chest pains, and breathing difficulties. The NTSB noted that this level of stress over an extended period of time could result in depression and contribute to a chronic state of fatigue.

In the Downeast Airlines report, the NTSB referred to several British studies on human performance and fatigue. These studies demonstrate that as individuals become more fatigued they become increasingly willing to accept lower standards of accuracy and performance. The studies note that fatigued pilots fail to integrate data from flight instruments. Instead, the pilots focus their responses upon a singular instrument, or group of instruments, often neglecting fundamental control actuation. Interestingly, the British studies document an increase in the number of errors at the end of the flight. The errors were caused by a performance deterioration which occurs as a result of relaxation and anticipation of

The NTSB also recognizes the need for a different approach in training. In 1977, the chairman of the NTSB pointed out that in the civilian pilot training environment as it existed, there was "no attempt to get at judgment." He criticized the existing teaching methodology, appropriately noting that "[y]ou don't teach people judgment by teaching them to jump through hoops." AVIATION CONSUMER, March 1, 1977, at 15.

NTSB REPORT No. AAR-80-5 (Downeast Airlines, Inc. De Havilland DHC-6-200, N68DE, Rockland, Maine, May 30, 1979) (The author of the present article was the FAA spokesman for the accident investigation hearings involving this accident).

Id. at 23.

Id. at 24.
flights' end. While the NTSB made no recommendations in the Downeast Airlines accident report regarding the need to study the judgment process, the NTSB's recognition of the factual analysis found in the British studies perhaps indicates the NTSB's awareness of the importance of learning about the process of fatigue, mental pressures and other psychological factors insidiously affecting pilot judgment and performance.

It was not until 1981 at a hearing concerning the Cascade Airways Beechcraft 99 crash in Spokane, Washington, on January 20, 1981, that the NTSB included a human factors expert on its panel of experts investigating the accident. Although much of the questioning by the NTSB human factors expert at the public hearing dealt with cockpit communication capability in high noise environment and the cognitive and sensory limitations of a pilot interacting with certain instruments, the investigation did include a flight crew behavioral profile describing the general personality characteristics of the crew. The investigation also included an analysis of the crew's operational behavior. As in the Downeast accident, the NTSB made no specific recommendation in the Cascade Airways accident report about the need for attitude and judgment training. Nevertheless, the NTSB probe is at least another indication of the need to understand the pilot judgment process in order to accomplish effective accident investigation and prevention.

Although the need to probe the cause of pilot error has been recognized, considerable restraints attend efforts to develop individual pilot profiles and behavioral characteristics after an accident. One restraint results from perhaps an understandable respect of privacy and reluctance of friends and relatives

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66 Id.
67 A. Diehl, supra note 62, at 2, 3, illustrates how varying emphasis on human performance could have produced quite different conclusions from an investigation of a typical accident such as the Downeast accident.
68 NTSB ACCIDENT REP. No. AAR-81-11 (July 21, 1981) (this author was the FAA spokesman for the accident investigation hearings involving this accident).
69 Id. at 16-18.
70 Id. at 17-18.
to divulge personal matters relating to the pilot. An investigator’s lack of training, skill, and experience may also hinder the quality of such discovery efforts. As an example, in the report of the accident of the Air Florida 737 at Washington, D.C., on January 13, 1982, the NTSB found that the crew made poor judgments in taking off with snow and ice adhesion on the wings and without using the engine anti-ice systems. 71

Regarding Air Florida crew experience and training, the NTSB recognized that by the time a person qualifies as a captain, he should be capable of detecting all of the situations encountered in the events which led up to the Air Florida accident. Nevertheless, the captain did not react to the first officer’s repeated comments that something was wrong on the takeoff roll or to evidence of pre-stall warnings after liftoff. The NTSB suggested that the first officer’s comments were not sufficiently assertive, but the in-depth reasons for the crew’s departure from basic experience and training were not unexplored. The NTSB simply expressed a belief that the training program should include considerations of command decision, resource management, role performance and assertiveness. 72

In light of developments in aviation psychology relating to pilot judgement, an in-depth analysis of behavioral traits and hazardous thought patterns would be far more helpful in finding ways of improving judgment than merely repeating suggestions of more or different training. The NTSB refrained from doing an in-depth analysis to determine what motivating psychological factors may have affected judgment in the Air Florida accident. It appeared that investigatory efforts in this

71 NTSB Accident Rep. No. AAR-82-8, at 2 (August 10, 1982). The NTSB also found that the power levels were not advanced to full thrust prior to impact because of the belief that the crew was concerned about exceeding engine thrust limitations due to their training. Id. at 66. NTSB regulations prohibit the take-off of an aircraft when frost, snow, or ice is adhering to the wings, control surfaces, or propellers of the aircraft. 14 C.F.R. § 121.629 (1982). Engine anti-ice prevents icing of the engine inlet pressure sensor which detects engine inlet pressure and, by comparing it to engine outlet pressure, gives a reading on the exhaust pressure ratio gauge indicating to the crew the amount of power the engine is generating. Ice blockage of the inlet probe results in a reading of more power than the engine is actually delivering.

72 NTSB Accident Rep. No. AAR-82-8, at 66-68 (August 10, 1982).
regard were thwarted by the industry and by disagreements within the NTSB itself. A probative analysis need not necessarily involve unwarranted invasions into the private lives of a crew because sufficient indicia of poor judgment traits and hazardous thought patterns may be found from training records, basic profiles and a psychological analysis of the information gathered by the cockpit voice recorder. We simply cannot continue to avoid "the real why" of these poor judgment accidents. The NTSB and the aviation industry must do more to investigate methodology in line with current developments in the study of judgment, self-awareness and behavioral modification to help prevent this type of accident.

As previously discussed, responsible entities, such as the FAA, NTSB, and segments of the aviation industry, not only recognize the need for more fully defining the real cause of poor judgment accidents, but these entities also recognize the feasibility and the benefits of educating pilots in positive judgment and behavioral modification. Whether the challenge to formally educate pilots will be met by efforts to integrate this increasing information into meaningful training processes remains to be seen. In any event, if attorneys and experts probe more deeply into the underlying causes of pilot error in aviation investigation and litigation, corresponding duties and increased standards of care will similarly develop.

In the law of tort, the concept of due care presupposes some uniform standard of behavior set by the demands of the community—the expectations of the reasonable person. In the

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This is the author's personal observation gathered while representing the FAA as spokesman in the Air Florida investigation and related NTSB accident hearing. In a recent effort to investigate human performance factors, the NTSB has revamped an old investigation report form to include more personal information about the pilots. However, it is still devoid of a search for data which would reveal pilot judgment and behavioral traits to a significant degree.

As an example, while taxiing toward the runway the first officer commented "... it's impressive that these big old planes get in here with the weather this bad you know, it's impressive" and "it never ceases to amaze me when we break out of the clouds, there's the runway, I don't care how many times we do it." NTSB Accident Rep. No. AAR-82-8, at 114-15 (August 10, 1982). These comments may be an example of a hazardous thought pattern such as invulnerability or an example of the effect of previously successful outcomes on future judgments. Such an analysis may help others to identify and correct such possible judgment traits in themselves.
ideal sense, the standard must be an external and objective one rather than one of the individual judgment, good or bad, of the actor. The law declares that objective standards dictate how the reasonable person will behave under a given set of circumstances. As Mr. Justice Holmes states, "[t]he law takes no account of the internal character of a given act so different in different men. It does not attempt to see men as God sees them, for more than one sufficient reason." The social judgments of the community, however, actually set the standard of resonableness. These community judgments are all but objective and permanent.

The community recognizes that the reasonable person must be expected to act differently from situation to situation and in accordance with his or her physical and intellectual capabilities—indeed subjective standards. For example, society expects a reasonably prudent airline pilot to be more capable than a novice. Likewise, factors such as mental capacity, disposition, age and specialized knowledge have resulted in a different case outcomes. Thus, mental capacity and disposition can be relevant factors in an action for punitive damages, in which a defendant's intention may be relevant. In other cases, because of the plaintiff's knowledge and capability, the plaintiff may have a duty to take advantage of a last clear chance to avoid an accident despite the negligence of the defendant. The standard of care, therefore, in the true sense involves the study of human behavioral traits and modifications.

As knowledge of human behavior has increased, the elements of due care have changed. For example, in aviation tort law the standard of care changed from one of absolute liability, which regarded the piloting of an aircraft as an ultra-hazardous activity akin to harboring a wild animal, to a recognition that perhaps an aeronaut might have some resemblance to a reasonably prudent person. This change of legal standard has been concomitant with an increased knowledge.

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77 Id. at 190.
Likewise, as the knowledge of the pilot's judgment process increases, the law regarding the duty of a reasonable person and defense strategies in tort cases will change. Regarding possible changes in the standard of care, if the concepts that most accidents are not caused by a singular event and that poor judgment accidents result from a poor judgment chain are accepted, the factors of proximate causes of accidents may be expanded.

A re-examination of the Deal accident may serve to demonstrate this point. In that case, the surgeon-pilot was under time pressure to arrive at his destination because he had a clinic to visit and was already committed time-wise to a decision to fly instead of drive. That pilot had little actual weather experience, but decided to file an instrument flight plan through an area of known icing conditions with no deicing or anti-icing equipment, although more experienced pilots with such equipment refused to fly that day. Because of an earlier report of adverse weather, he followed advice to wait a few minutes until the later report was available. Although the later report indicated worsening weather, he decided to make the flight. In all likelihood, the pilot believed that planning the flight at the higher altitude to avoid the reported icing would cause further delay, and would be inconvenient because the destination airport was so close.

While enroute, the pilot encountered icing conditions. He requested and received a clearance for a higher altitude. When he reached the higher altitude, he reported that the ice was

78 See, e.g., Lange v. Nelson-Ryan Flight Service, Inc., 108 N.W.2d 428 (Minn. 1961), aff'd on re-appeal, 116 N.W.2d 266 (Minn. 1962), cert. denied, 371 U.S. 953 (1963) (recognizing that the act of flying has been brought out of a state where aircraft generally do not meet with disaster in the absence of some act of negligence); Crist v. Civil Air Patrol, 278 N.Y.S.2d 430, 433-34 (Sup. Ct. 1967) (“[t]echnological advances and development, and the experiences of the last two decades have dissipated the universal early fears that flying was an ultrahazardous occupation”); Baldwin, Liability for Accidents in Aerial Navigation, 9 Mich. L. Rev. 20 (1910).
79 See supra notes 2-9 and accompanying text.
81 Id. at 634.
82 Id. at 635.
beginning to break up. Instead of remaining at the higher altitude until the ice dissipated from the aircraft, the pilot requested to descend back into the area of known icing conditions to land at his destination airport rather than to turn back or go to an alternate airport. The pilot executed an instrument approach, but in a cross wind he overshot the base leg of the traffic pattern. Rather than execute a missed approach, he banked the aircraft too steeply to correct the overshoot, stalled, and crashed.\textsuperscript{8} The court found that the crash was caused by the overbank, aggravated by a further loss of lift due to the ice buildup.\textsuperscript{8}

Clearly, the pilot committed an act of poor judgment, but in the judgment chain concept the final act, the overbanking of the aircraft, was not the only cause of the accident. The first error in judgment was a decision to fly instead of drive. The pilot let his desire to arrive at this destination on time take precedence over his concern for a safe flight. The pilot either overestimated his abilities or felt that he was impervious to poor decisions. Most courts would consider the earlier acts as being too remotely connected with the more direct cause of the crash, the pilot’s negligence in banking too steeply. If the pilot, however, as part of his training curriculum, knew how to recognize the poor judgment chain and the need to break it as early as possible, then an earlier act might be considered as much of a proximate cause as banking the aircraft too steeply.

To carry this concept further, assume that the pilot knew he had an expired medical certificate.\textsuperscript{8}\textsuperscript{8} Most courts would not regard the fact as relevant without a showing that the expired medical certificate was connected with the accident. If the pilot, however, was charged with the knowledge that proceeding with the flight without the proper certificate may be the first link in a poor judgment chain and the pilot was taught to break that chain before it led to other decisions, then the pil-

\textsuperscript{8} Id. at 635-36.
\textsuperscript{8} Id.
\textsuperscript{8}\textsuperscript{8} 14 C.F.R. § 61.103(c) (1982) requires the pilot to hold at least a current third-class medical certificate, the requirements for which are contained in 14 C.F.R. § 67.17 (1982). A third-class certificate is valid for two years. Id.
lot’s failure to react in accordance with this knowledge might be admissible evidence on a proximate cause of the accident.

Reviewing the Deal accident with reference to the hazardous thought patterns identified in the Embry-Riddle Study, at least two hazardous thought patterns are indicated. The pilot’s insistence to change the filed altitude from seven thousand to five thousand feet, made as a retort to the FSS specialist’s advice that “seven would probably be better,” may be indicative of “anti-authority” thinking. This conduct may also be indicative of symptoms of “invulnerability.” Curiously, the FSS specialist stated that this pilot was known to act contrary to advice. This fact, which may have been probative as to the reputation of the pilot, was not introduced because it seemed too remotely connected with the cause of this particular accident. If the pilot was trained to recognize and correct hazardous thought patterns, however, this type of evidence, particularly along with the judgment chain concept, may be probative on the issue of an expanded duty of care.

An analysis of crew behavior in the crash of Eastern Airlines flight 212 near Charlotte, North Carolina, on September 11, 1974, may reveal another hazardous thought pattern—“external control.” For nearly the entire flight, the crew complained of problems caused by others; for example, the Arabs, the Swiss, the Blacks, and other external factors. As a result, the crew failed to complete their landing checklist and failed to heed their instruments which resulted in the crew literally flying the airplane into the ground. In the lawsuits that followed, Eastern Airlines and its insurers alleged that the air traffic controllers should have prevented the accident by monitoring the descent of the aircraft on the radar in order to notify the crew that the aircraft was flying too low. See supra notes 50-60 and accompanying text.

413 F. Supp. at 635.

This information was learned by the author during witness briefings in preparation for the trial.


A transcript of the cockpit voice recorder tape is contained in the NTSB Accident Report. Id. at appendix E.

See Arnold v. Eastern Airlines, Inc., 16 Av. Cas. 17,592 (W.D.N.C. 1980), aff’d,
ing to establish evidence showing a hazardous thought pattern, the government began its opening statement in the case with the submission that “[t]his was a situation where supposedly professional airline pilots flew their airplane into the ground while talking about what was wrong with everyone else,” which is evidence of the classic hazardous thought pattern of “external control” categorized in the EMBRY-RIDDLE STUDY.

The court found that there existed an attitude of complacency not only in the cockpit of the aircraft, but also in the company as a whole. The evidence suggested that a hazardous thought pattern can be exhibited not only by a single person but also by a chain of people. In this case the pattern extended from the crew to supervisory personnel within the airline company. Thus, in the judgment chain concept, proximate causes of accidents can be extended to relate to actions on the part of many others in addition to pilots.

Additionally, as the development of methodologies increases, an individual pilot will be able to perform individual behavioral profiles for self-study. As the ability to be self-aware of our thought processes increases, it is safe to assume that a duty to be self-aware will also increase. Thus far, the courts have not been reluctant to recognize that pilots have a duty to know not only the capability and limitations of their aircraft, but also their own capacity. In fact, the pilot’s duty has been further specified as a duty to be aware of one’s own inexperience. The EMBRY-RIDDLE STUDY stated that “[t]he pilot must consider all the facts which have, or should have,

681 F.2d 186 (4th Cir. 1982).

**The defense of the air traffic controllers and the United States was tried by this author. The opening statement appears only in the trial transcript.**

**16 Av. Cas. at 17,592.**


**Bandy v. United States, 492 F. Supp. 13, 22 (W.D. Tenn. 1978), aff’d, 628 F.2d 935 (6th Cir. 1980) (involving a flight into adverse weather by a pilot without sufficient experience).**
an influence upon his or her decision-making process." The extent to which a pilot may be held responsible for knowing his or her judgment capabilities or behavioral traits under various situations will depend, of course, on advances in this field.

There may be increased responsibilities attending flight instruction as the study of human behavior develops. In the field of education, it has been held that a training institution may be liable for the negligent acts of the student which are attributable to a lack of or improper training. The FAA not only attempts to educate flight instructors on some of the basics of human behavior, and the recognition and correction of hazardous patterns in the students, but the FAA also holds the flight instructors responsible, to some extent, for meeting a minimum standard of knowledge of human behavior as part of their certification requirements. Whether liability will attach to deficiencies in flight instructions, particularly relating to judgment training, is a question which remains open. Indeed, it may be a future development in the law.

New advances in evaluation and training of attitude and judgment may bring about different approaches regarding defense strategies. As an example, a study entitled An Analysis of Aircrew Procedural Compliance suggests that information which may be considered important to one pilot or crew may be irrelevant to another pilot's judgment depending upon the situation to be faced. The study explains that a seasoned crew faced with an emergency, for example, may regard information as to the nearest airport to be the most critical, while a new pilot may want to know more about what help he can get from the ground, such as the availability of surveillance ap-

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96 Embry-Riddle Study, supra note 51, at 3-4.
97 See, e.g., Rodriguez v. Brunswick Corp., 364 F.2d 282 (3rd Cir. 1966) (holding a training institution liable for the negligent act which a student learned either by example or tacit permission). See also Stehn v. Bernarr McFadden Found., Inc., 434 F.2d 811 (6th Cir. 1970).
98 14 C.F.R §§ 61.183(d), 61.185 (1982).
proaches and direction finding capability.\textsuperscript{100} As a possible application to cases wherein it is charged that inadequate weather or other information dissemination or lack of certain warnings caused the accidents, it may be shown that while the subject pilots did not receive the entire quantity of available information, they did receive sufficient qualitative information to be able to make safe decisions. It may become possible to obtain a profile of a pilot or crew based upon their actions in previous situations to project how they would have acted if they had received the missing information or warning. Such a projection may demonstrate that the missing information or warning, if received, would not have resulted in an alternate decision, which is evidence on the issue of proximate cause.

The information gathered from developments in the evaluation and modification of the judgment process in aviation may well be applicable to the evaluation and methodology used in briefing and examination of witnesses at trial. Visiting the Deal accident once again, a comparison between two opposing pilot expert witnesses reveals such applicability of the study of behavioral traits and hazardous thought processes. The plaintiff's expert, with a background as a Navy fighter pilot, testified essentially that he was qualified and would not have hesitated in commencing the subject flight in the weather conditions as in which surgeon-pilot flew—the "macho" approach. On the other hand, the expert witness for the defense, a pilot who had all pilot ratings and 50,000 hours of flight experience in nearly every type of civil aircraft beginning from the early twenties, in response to a challenge of his expertise, was asked to admit that despite all his credentials he did not have sufficient qualifications and experience to have commenced such a flight under these same conditions. He admitted that he did not. Fortunately for the defense, the expert had no need to prove himself, thus, the challenge literally backfired. The plaintiff's witness, somewhat identified with the plaintiff's decedent pilot, became cast as a person who took chances in comparison to a person who was obviously

\textsuperscript{100} \textit{Id.} at 138.
more experienced and qualified and willing to recognize the limitations of his abilities. This example demonstrates how important it is for an attorney to be able to assess behavioral traits and understand modification techniques in briefing and examination of witnesses and in planning trial strategy generally. Thus, the subject of aviation psychology, particularly the study of pilot judgment, in many ways can be fruitful for the lawyer as it is for the pilot. It can win lawsuits as well as prevent accidents.

CONCLUSION

The study and efforts to achieve positive modification of pilot judgment and behavior are beginning to take place to a significant extent in accident investigations, the field of aviation psychology, and in litigation. Because these advances will bring with them new concepts in tort law that will affect the evolution of the standard of care and the elements of proximate cause in litigation, attorneys should keep abreast of new developments in this subject. What is more important than its potential influence in the courts, is that the development in this area will enhance pilot training and education and thus minimize the number of pilot error accidents.