

# A Review of the Literature Pertaining to Decision Making in Aviation

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This presentation is set up as a “simple conversational outline.” Complete details and results of relevant research and studies are expanded on in the full paper. A full reference list will also be found in the full paper.

# Case 1

## 14 CFR Part 91: General Aviation

### Injuries: 6 Fatal

*The pilot's improper decision to continue VFR flight into IMC conditions and his failure to maintain terrain clearance, which resulted in controlled flight into terrain. Factors were night, snow and a low ceiling. (NTSB Accident Identification # NYC04FA092, 2004).*

***Improper Decision!***

## Case 2

### 14 CFR Part 91: General Aviation

### Injuries: 3 Fatal

*The pilot's failure to maintain aircraft control during the missed approach. Factors to the accident were; the pilot's improper decision to attempt the approach in weather conditions below the approach/landing minimums, the weather, the pilot's lack of multiengine instrument experience, and spatial disorientation by the pilot. (NTSB Accident Identification # CHI00FA080, 2001).*

**Improper Decision!**

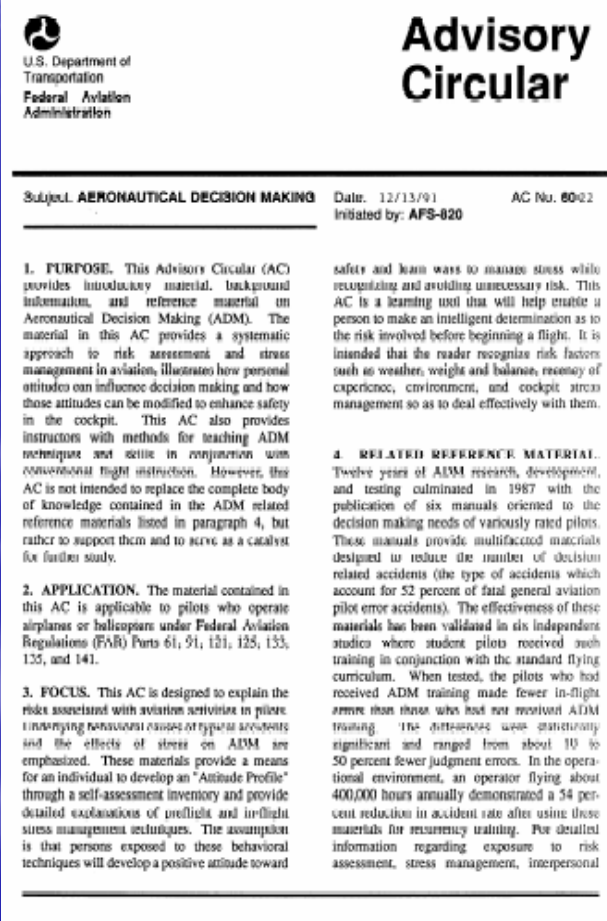
# Basics

- Between 50% and 75% percent of GA accidents are caused by faulty decisions
- This statistic does not appear to be improving
- Weather-related decisions are still the most problematic
  - **Specifically, continued VFR flight into IMC conditions by non-instrument rated pilots**
  - **Other weather related problems include scud running, “duck unders,” and improper fuel planning.**



# FAA Guidance

- Can be found in Advisory Circular 60-22 (Aeronautical Decision Making), 1991
- Includes information on the Five Hazardous Attitudes and DECIDE models.



The image shows the cover of an FAA Advisory Circular. At the top left is the FAA logo and the text "U.S. Department of Transportation Federal Aviation Administration". At the top right is the title "Advisory Circular". Below this, the subject is "AERONAUTICAL DECISION MAKING", the date is "12/13/91", and the AC number is "60-22". The subject was initiated by "AFS-020". The main body of the cover contains three sections: 1. PURPOSE, 2. APPLICATION, and 3. FOCUS. A fourth section, 4. RELATED REFERENCE MATERIAL, is partially visible on the right side.

**U.S. Department of Transportation  
Federal Aviation Administration**

**Advisory Circular**

Subject: **AERONAUTICAL DECISION MAKING** Date: 12/13/91 AC No. 60-22  
Initiated by: **AFS-020**

**1. PURPOSE.** This Advisory Circular (AC) provides introductory material, background information, and reference material on Aeronautical Decision Making (ADM). The material in this AC provides a systematic approach to risk assessment and stress management in aviation, illustrates how personal attitudes can influence decision making and how those attitudes can be modified to enhance safety in the cockpit. This AC also provides instructors with methods for teaching ADM techniques not used in conjunction with conventional flight instruction. However, this AC is not intended to replace the complete body of knowledge contained in the ADM related reference materials listed in paragraph 4, but rather to support them and to serve as a catalyst for further study.

**2. APPLICATION.** The material contained in this AC is applicable to pilots who operate airplanes or helicopters under Federal Aviation Regulations (FAR) Parts 61, 91, 131, 135, 135, and 141.

**3. FOCUS.** This AC is designed to explain the risks associated with aviation activities in pilots involving recurrent causes of repeat accidents and the effects of stress on ADM are emphasized. These materials provide a means for an individual to develop an "Attitude Profile" through a self-assessment inventory and provide detailed explanations of preflight and in-flight stress management techniques. The assumption is that persons exposed to these behavioral techniques will develop a positive attitude toward safety and learn ways to manage stress while recognizing and avoiding unnecessary risk. This AC is a learning tool that will help create a person to make an intelligent determination as to the risk involved before beginning a flight. It is intended that the reader recognize risk factors such as weather, weight and balance, economy of experience, environment, and cockpit stress management so as to deal effectively with them.

**4. RELATED REFERENCE MATERIAL.** Twelve years of ADM research, development, and testing culminated in 1987 with the publication of six manuals oriented to the decision making needs of variously rated pilots. These manuals provide multifaceted materials designed to reduce the number of decision related accidents (the type of accidents which account for 52 percent of fatal general aviation pilot error accidents). The effectiveness of these materials has been validated in six independent studies where student pilots received such training in conjunction with the standard flying curriculum. When tested, the pilots who had received ADM training made fewer in-flight errors than those who had not received ADM training. The differences were statistically significant and ranged from about 10 to 50 percent fewer judgment errors. In the operational environment, an operator flying about 400,000 hours annually demonstrated a 54 percent reduction in accident rate after using these materials for recurrent training. For detailed information regarding exposure to risk assessment, stress management, interpersonal

# The Five Hazardous Attitudes

1. Antiauthority
2. Impulsivity
3. Invulnerability
4. Macho
5. Resignation.

# The DECIDE Model

D- Detect

E- Estimate

C- Choose

I- Identify

D- Do

E- Evaluate

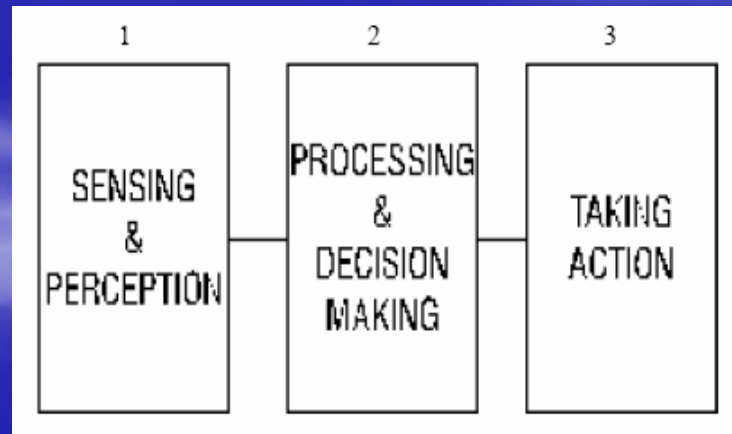
\* This is an iterative process.





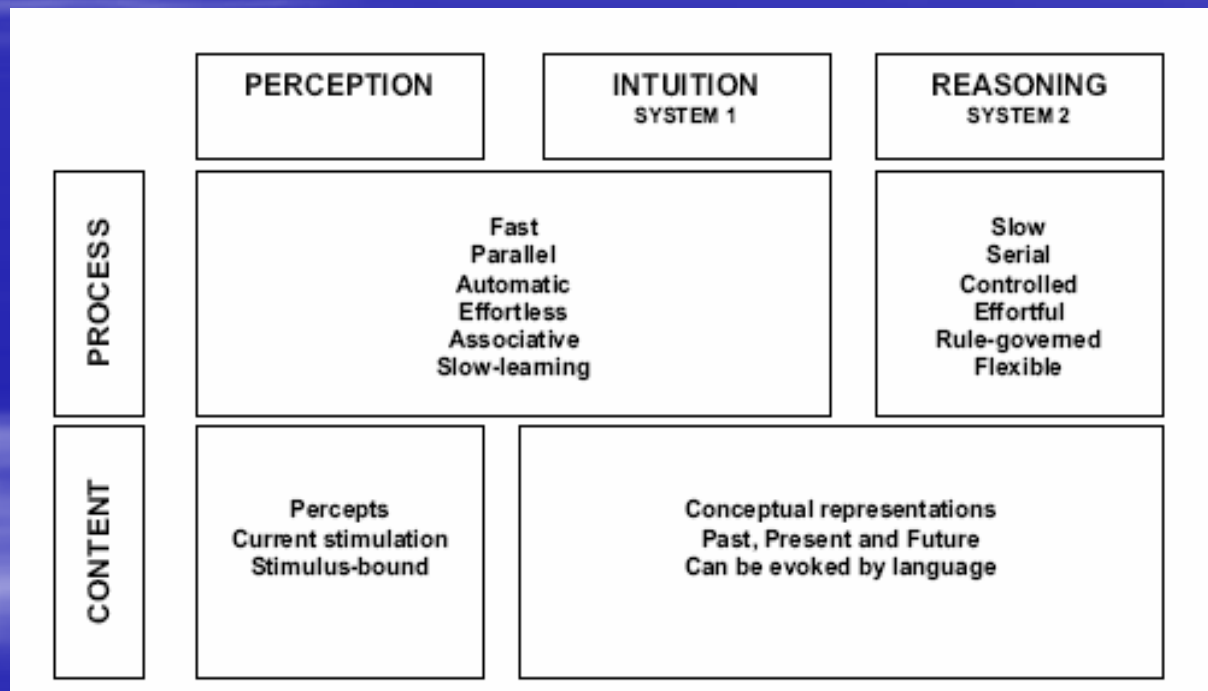
# Judgment

- Judgment can be taught
- Studies have shown positive effects in pilot judgment training
- Cognitive judgment is analogous to a computer system.



# Judgment

- Another, more in-depth model, depicts a two system process (Kahneman, 2002).

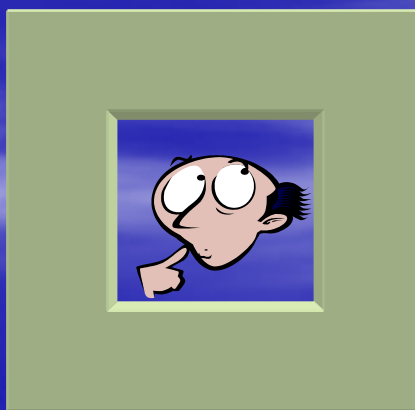


# Decisions

- Decisions relating to weather are the most problematic
- Some factors that contribute to flawed decisions are:
  - Framing effects (prospect theory; gains and losses)
  - Hindsight bias
  - Heuristics
  - Satisficing
  - Cognitive dissonance.

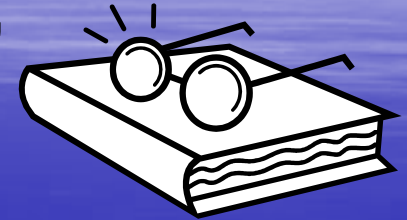
# Framing Effects

- Decisions may be framed as “gains or losses”
- When situations are viewed in terms of gains, people are risk averse, but when situations are viewed in terms of losses, people are risk seeking.



# Hindsight Bias

You've heard of "20/20 hindsight?"



Hindsight bias is the tendency to view what has already happened as relatively inevitable and obvious—without realizing that retrospective knowledge of the outcome is influencing one's judgments (Plous, 1993).



# Heuristics

- What the heck is a heuristic?
- Heuristics can be thought of as sets of empirical rules or strategies that operate, in effect, like a rule of thumb (Solso, 2001)



- Can be great for simple problem-solving but can create flawed decisions for more novel situations.

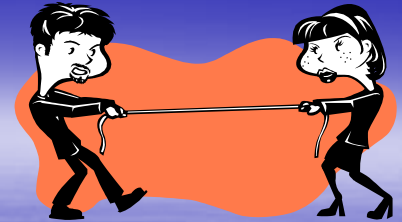
# Satisficing

- A behavior which attempts to achieve at least some minimum level of a particular variable, but which does not strive to achieve its maximum possible value (Simon, 1957)



- Related to this is *bounded rationality*, where people are emotional or irrational in parts of their decisions.

# Cognitive Dissonance



- A pair of cognitions that can be either consonant or dissonant (Festinger, 1957)
- Can be viewed as a “mental tug of war”
- Arriving at your destination airport, as planned, no matter what, + illegally descending below DH on the approach = cognitive dissonance
- Pressure can exacerbate dissonance.

# **“Jet Crashes Before Picking up Elder Bush”**

## **11-22-2004**

**A private jet that was en route to Houston to pick up former US President Bush clipped a light pole and crashed Monday as it approached Hobby Airport in thick fog, killing all three people aboard.**



# Breaking Research on Weather Decisions...



A new study just released by the NTSB  
(2005) found the following...



# Breaking Research on Weather Decisions...

- Pilots who start flying earlier in life are at lower risk of being involved in a weather related general aviation accident than those who start flying when they are older, and age at first certificate is a better predictor of future accident involvement than age at time of flight.
- The observed connection between age and accident risk in this study is not likely due to physical aging issues, but to other factors associated with the age at which a person starts flight training.

# Breaking Research on Weather Decisions...

- Periodic training and evaluation may be necessary to ensure that pilots maintain weather-related knowledge and skills.
- Knowledge and practical test failures are both associated with a higher risk of a pilot being involved in a weather-related general aviation accident.
- A pilot can incorrectly answer all questions relating to weather on an airman knowledge test and still receive a passing score on the test.

# Breaking Research on Weather Decisions...

- A history of accident or incident involvement is associated with a higher risk of being involved in a future weather-related general aviation accident.
- General aviation pilots routinely consult alternative sources of aviation weather to obtain information that is not currently available from a standard weather briefing.

The full NTSB report is available at:

<http://www.nts.gov/publictn/2005/SS0501.pdf>

# Aftermath of a Fatal Decision



On January 10, 2004, about 1840 central standard time, a Cessna 182P, N5787J, was destroyed during an in-flight collision with trees and terrain 7 1/2 miles southwest of the Baudette International Airport, Baudette, Minnesota. Night instrument meteorological conditions prevailed at the time of the accident. The non-instrument-rated pilot and passenger sustained fatal injuries (CHI04FA055).

# Another Fatal Decision



On November 2, 2003, at 1847 central standard time, a Commander Aircraft 114TC, N8107Z, piloted by a private pilot, was destroyed during an in-flight collision with terrain at the Hutchinson Municipal Airport, Hutchinson, Kansas. The pilot was fatally injured. Night instrument meteorological conditions prevailed at the time of the accident (CHI04FA025).



**Surely, there must be a few  
questions...**



*Thank you for your  
time!*

