

# Soaring Safety Summit

Decision Making, Judgment  
& Airmanship

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11 March 2006



“Good judgment comes from experience,  
Experience comes from poor judgment.”

On the last day of the Persian Gulf War, an F-16 descended below established altitude restrictions to attack an Iraqi column, and was shot down. As a consequence, the Army rescue helicopter attempting to rescue the downed pilot was shot down, killing all five on board.

A British Midlands B-737 experienced an engine fire in flight. The crew shut down the wrong engine and crashed along a motorway.

An experienced GA pilot went off supplemental oxygen at FL250 with known pressurization problems in a Cessna 340. He became hypoxic and could not resume control of his aircraft. It ran out of fuel and crashed nearly four hours after takeoff.

A pilot with over 500 hours in his open-class sailplane, retired from the Air Force after 20 years as a fighter pilot with actual combat experience. He was seen thermalling at low altitude, from which he spun, did not recover, and lost his life in the crash.



# History of ADM research

- 1919 — Henmon, “Air service test of aptitude for flying.”
- 1942 — Kelly & Ewart, “A preliminary study of certain predictors of success in civilian pilot training.”
- 1946 — Kunkle, “The psychological background of 'pilot error' in aircraft accidents.”
- 1976 — Thorpe et al., “Situational emergency training: F-15 emergency procedures training program.”
- 1977 — Jensen & Benel, “Judgment evaluation and instruction in civilian pilot training.”
- 1993 — Adams, “How expert pilots think: cognitive processes in expert decision making.”

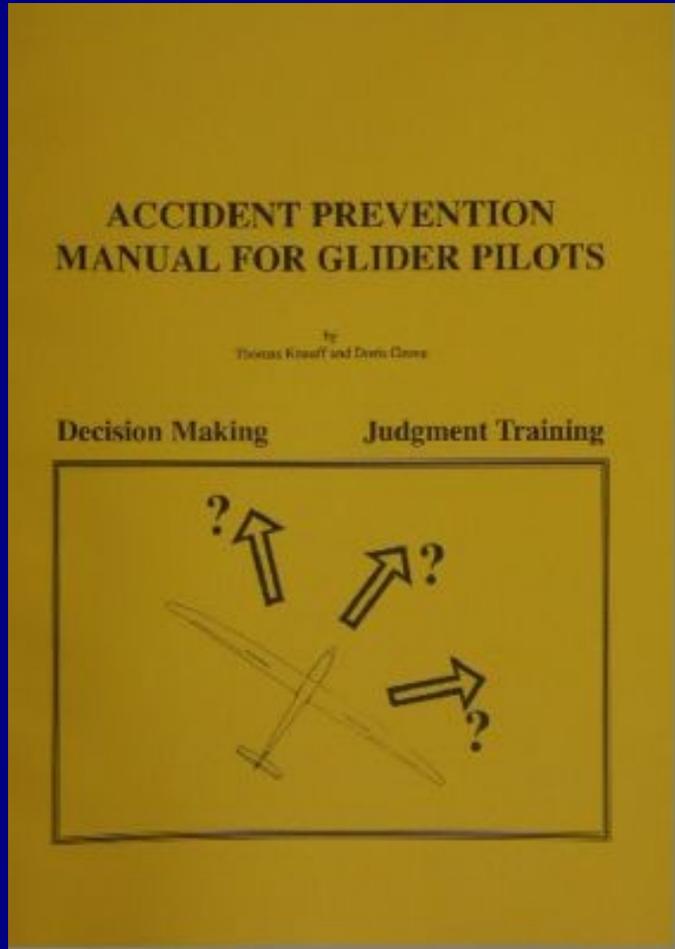
# Pilot Error

- Judgmental Error
- Control Error
- Procedural Error

| Pilot Activity   | Fatal Accidents | Non-fatal Accidents |
|------------------|-----------------|---------------------|
| Decisional       | 2,940 (52%)     | 9,081 (35%)         |
| Perceptual-motor | 2,496 (44%)     | 14,561 (56%)        |
| Procedural       | 264 (4%)        | 2,230 (9%)          |

# Poor judgment chain

- A **series of mistakes** that may lead to an accident or incident. Two basic principles generally associated with the creation of a poor judgment chain are:
  1. One bad decision often leads to another; and
  2. As a string of bad decisions grows, it reduces the number of subsequent alternatives for continued safe flight.
- **Break the poor judgment chain** before it can cause an accident or incident.



- *AC 60-22, Aeronautical Decision Making*

know yourself

know your team

know your aircraft

know your environment

know your risk

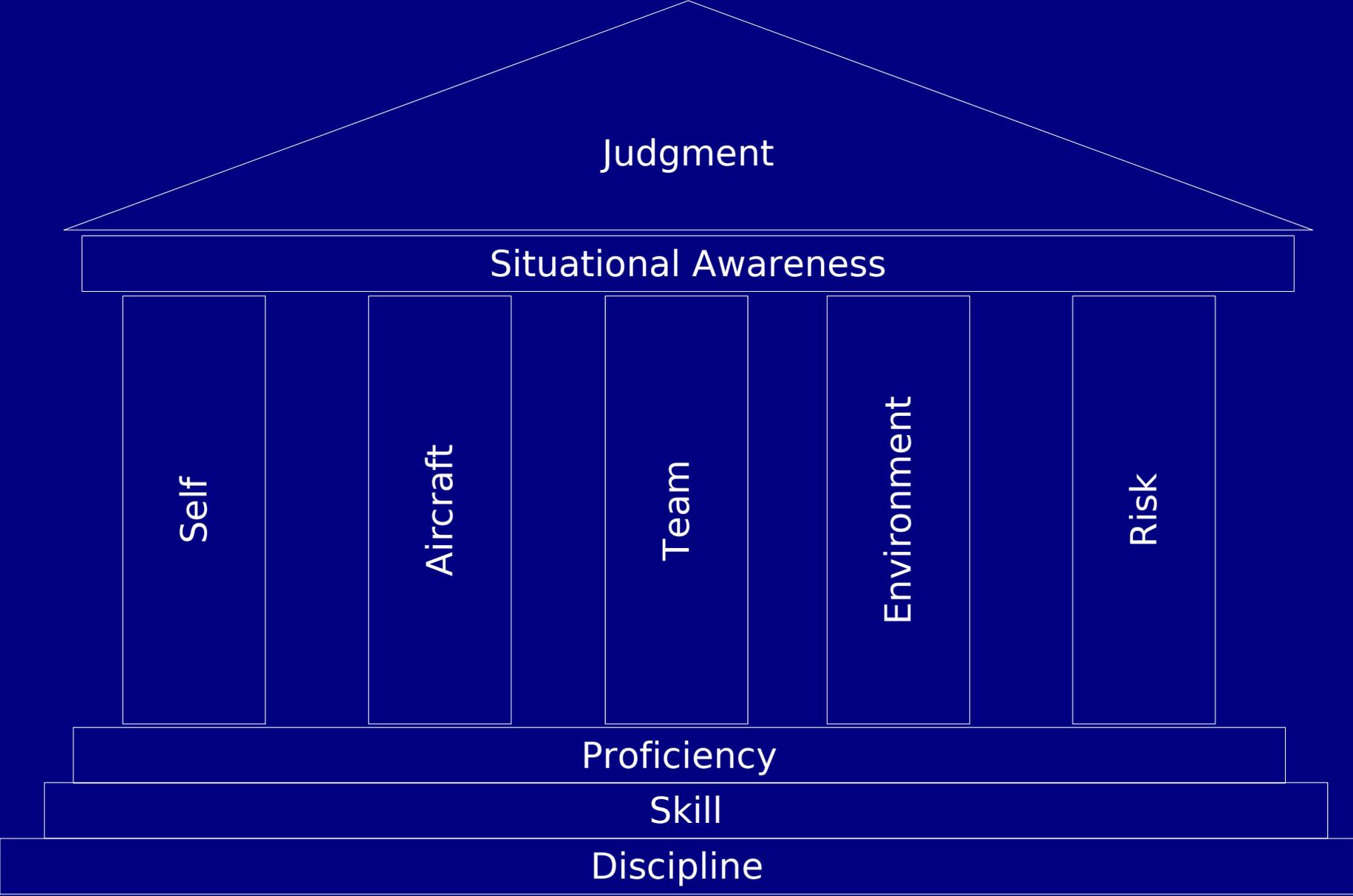


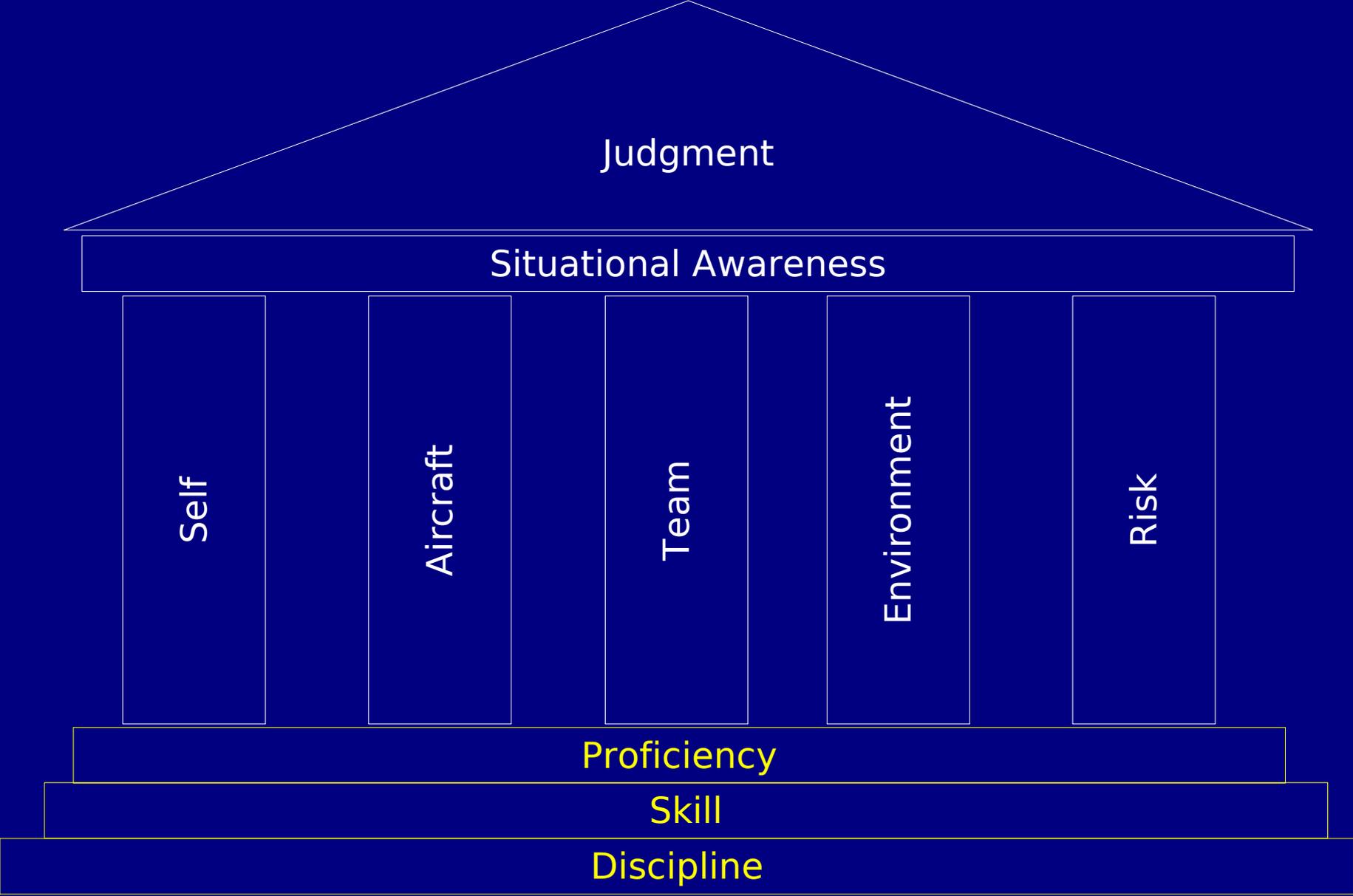
# Redefining Airmanship

Tony Kern

# Airmanship model

- What is judgment?
  - Good hands (skill)
  - Common sense
  - Discipline
  - Situational awareness
- What is necessary for good judgment?
  - Experience — NO!
  - Knowledge — of what?
- What is necessary for good decisions?
  - Good judgment
  - What else?





# Airmanship: Foundations Discipline

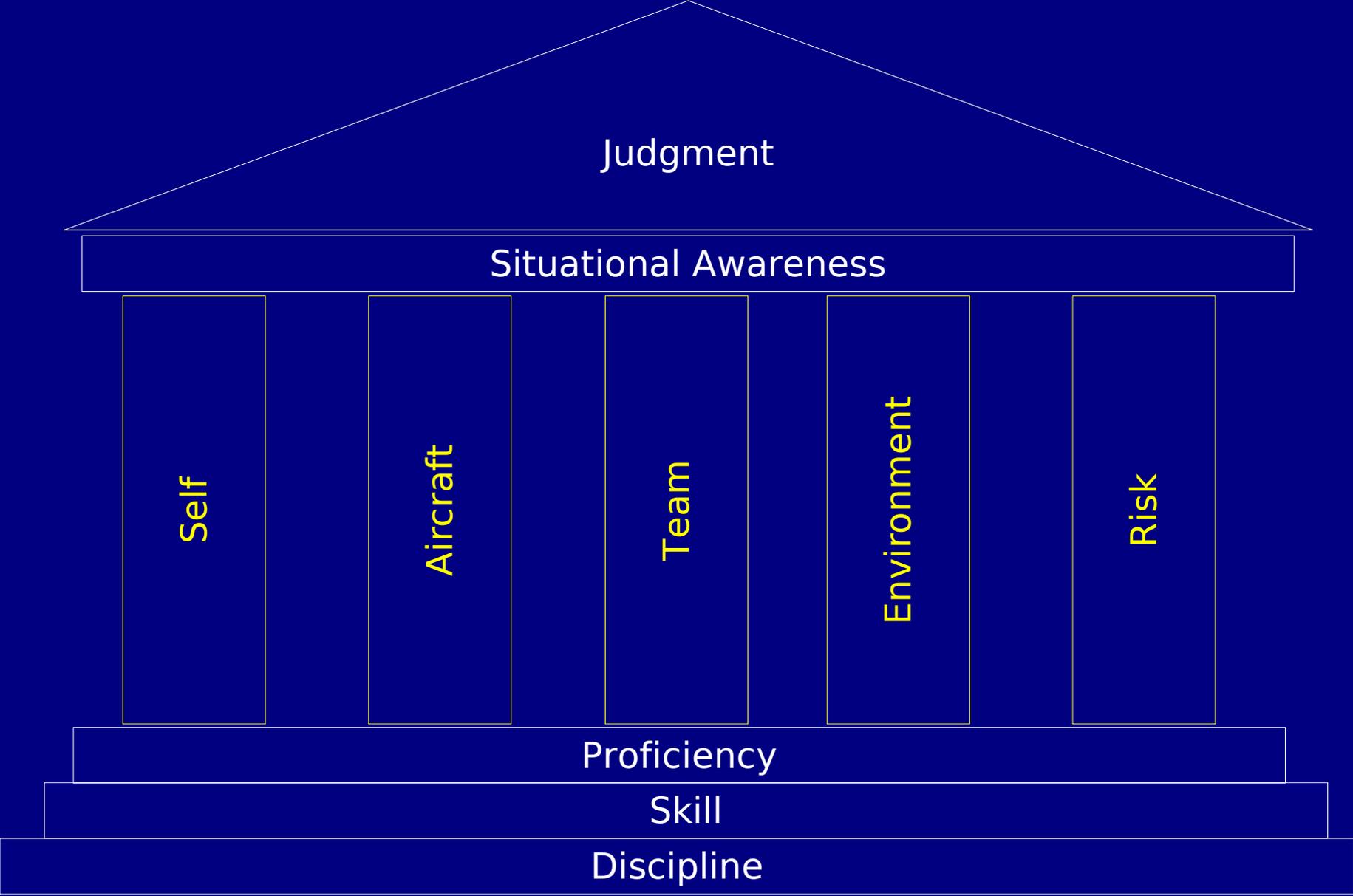
- **Ability and willpower** to safely employ an aircraft within operational, regulatory, organizational, and common sense guidelines — unless emergency demands otherwise.
- Ability and willpower imply a conscious act.
- Compliance: POH, FARs, club rules.
- Special circumstances.
- Rogue Aviator:
  - *Flight Discipline*
  - *Darker Shade of Blue*

# Airmanship: Foundations Skill & Proficiency

- Four levels of skill:
  1. Safety — checkout.
  2. Effectiveness — basic mastery.
  3. Efficiency — more efficient than standards require.
  4. Precision and continuous improvement — seek perfection as a continuing motivation for personal improvement.

# Airmanship: Foundations Skill & Proficiency

- Current vs. Proficient.
- Skill loss occurs rapidly in areas that require finesse.
- Mental proficiency.
  - Visualization techniques — chair flying.
- Personal skills development plan
  1. Development goal.
  2. Define and locate resources.
  3. Define education/training requirements.
  4. State specific objectives.
  5. Plan instruction.
  6. Conduct training and re-evaluate skill level.



# Airmanship: Pillars

## Know yourself

- Psychological airworthiness
  - Stress.
  - Hazardous attitudes.
- Medical airworthiness
  - Illness — Any symptoms?
  - Medication — Prescription or OTC drugs?
  - Stress — Work, financial, health, family?
  - Alcohol — Drinking within 8 hours? Within 24?
  - Fatigue — Tired, not rested?
  - Eating — Adequately nourished?1

# Airmanship: Pillars

## Know yourself

- Hazardous attitudes
  - Anti-authority — “Don't tell me!”
  - Impulsivity — “Do something quick!”
  - Invulnerability — “It won't happen to me.”
  - Macho — “I can do it.”
  - Resignation — “What's the use?”

# Airmanship: Pillars

## Know yourself

- Antidotes to hazardous attitudes
  - Anti-authority — “Follow the rules.”
  - Impulsivity — “Not so fast, think first.”
  - Invulnerability — “It could happen to me.”
  - Macho — “Taking chances is foolish.”
  - Resignation — “I'm not helpless, I can make a difference.”

# Airmanship: Pillars

## Know your aircraft

- Where to start:
  - POH
  - Instruments:
    - GPS-NAV & glide computer
    - Varios
- Key to expertise: continuous and systematic study.
- Unwritten knowledge: avoid the “gotchas.”

# Airmanship: Pillars

## Know your team

- Instructor, wingman, other glider pilots, tow pilot, crew.
- Communications.
- Leadership & followership.
  - Active, independent thinkers.
- Crew/cockpit resource management.

# Airmanship: Pillars

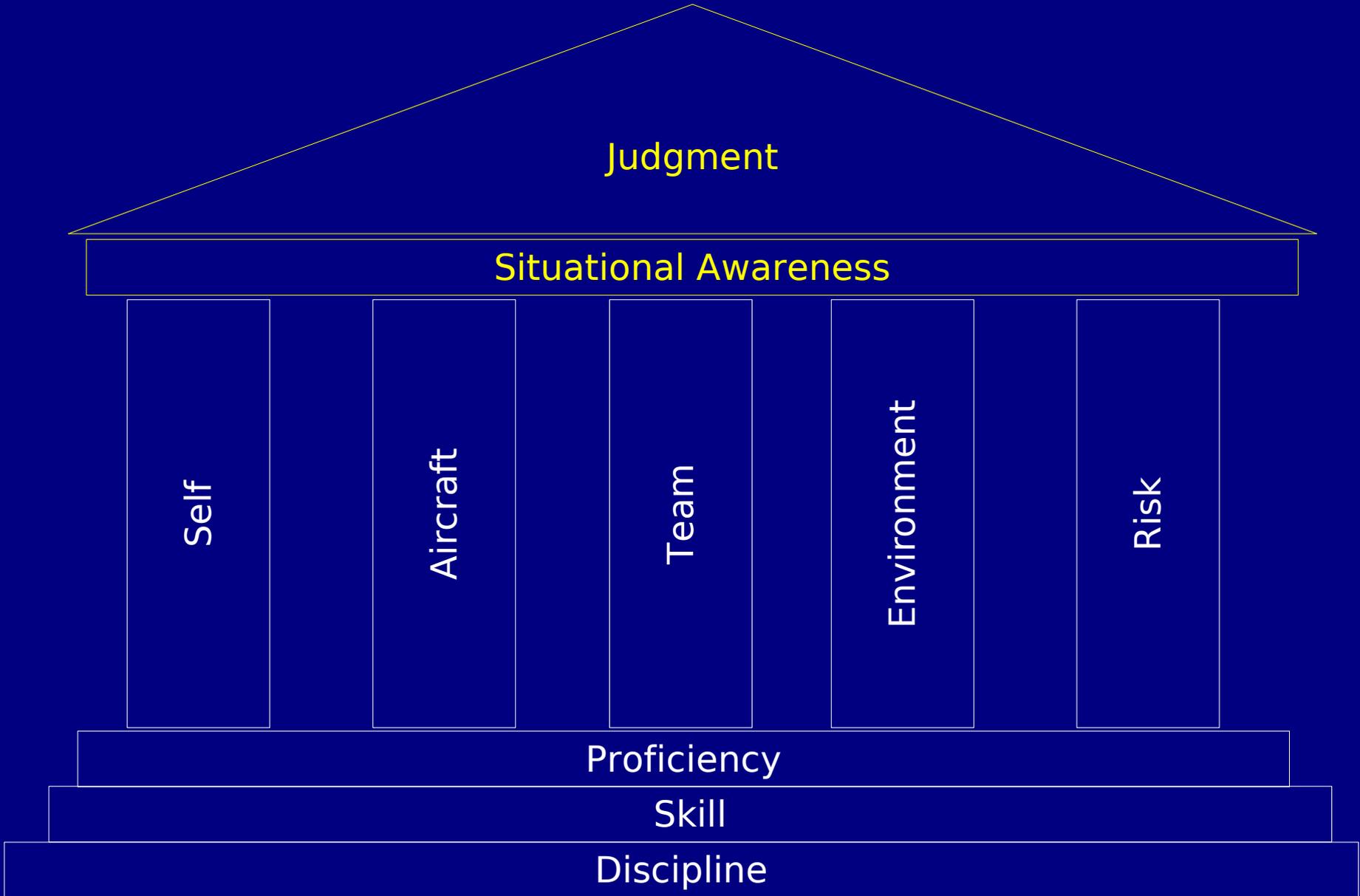
## Know your environment

- Physical environment
  - Weather, airport, altitude.
- Regulatory environment
  - ATC regulations
  - Airman certification
  - Aircraft & equipment
- Organizational environment

# Airmanship: Pillars

## Know your risk

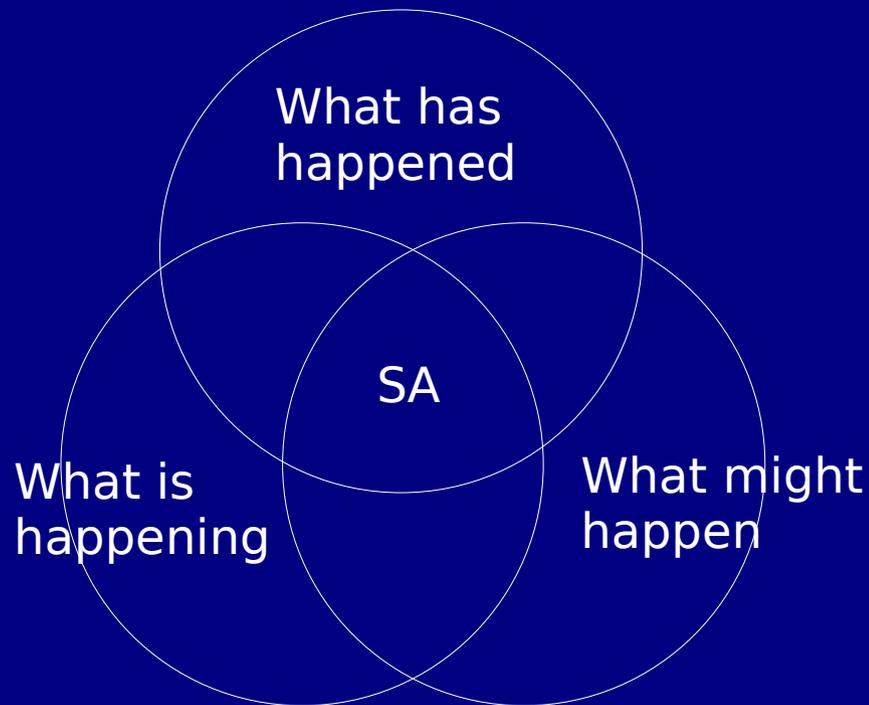
- Reason for risk: **no risk, no opportunity.**
- Risk identification: different levels of risk.
- Risk to discipline.
- Risk to skill and proficiency.
  - Problem: demands > capabilities.
- Risk to knowledge.
  - Attitude to learning
- Risk to situational awareness and judgment.



# Airmanship: Capstones

## Situational Awareness

- Occurs in four-dimensions: time and space
- Analyze past and present to prepare for future.



# Airmanship: Capstones

## Situational Awareness

- Level 1: perceive a relevant cue.
  - Incorrect data
  - Misinterpreted information
- Level 2: put the observation into the Big Picture.
  - Ability to match significance to event
  - Influenced by
    - Pillars of knowledge
    - Experience (hangar flying)

# Airmanship: Capstones

## Situational Awareness

- Lost SA
  - Can occur gradually or all at once.
  - Seriously degrades the ability to achieve flight objectives.
  - Prime factor in accidents.
  - Nearly always sufficient clues available for recognition and recovery.

# Airmanship: Capstones

## Situational Awareness

- Lost SA: Cues
  - Ambiguity or confusion
  - Fixation
  - Poor communication
  - Failure to meet targets
  - Reduced maneuvering
  - Failure to stay ahead of the aircraft
  - Undocumented procedure or violation of a minimum

# Airmanship: Capstones

## Situational Awareness

- Recovering SA
  - Fly the aircraft
  - Buy time — climb!
  - Seek information
  - Learn from the experience

# Airmanship: Capstones

## Situational Awareness

- Improving SA
  1. Define roles (team).
  2. Manage distractions.
  3. Reduce overload.
  4. Avoid complacency.
  5. Test assumptions.
  6. Intervene.

# Airmanship: Capstones

## Judgment

- Rational judgment
  - Sense, store, retrieve, and integrate information
- Motivational judgment
  - Motivation and attitudes
- Decision making
  - Action and response
  - Process

# Airmanship: Capstones

## Rational Judgment

- Mental ability to
  - Detect, recognize, and diagnose problems;
  - Establish available alternatives;
  - Determine risk associated with each alternative.
- Uses information that is **probabilistic**; therefore, outcomes are **uncertain**.
- Req's knowledge, experience, organized mental structures, systematic problem solving.

# Decision making and behavioral biases

- anchoring:** the tendency to rely too heavily, or "anchor," on one trait or piece of information when making decisions.
- bandwagon effect:** the tendency to do (or believe) things because many other people do (or believe) the same.
- belief bias:** the tendency to base assessments on personal beliefs.
- belief overkill:** the tendency to bring beliefs and values together so that they all point to the same conclusion
- bias blind spot:** the tendency not to compensate for one's own cognitive biases.
- choice-supportive bias:** the tendency to remember one's choices as better than they actually were.
- confirmation bias:** the tendency to search for or interpret information in a way that confirms one's preconceptions.
- congruence bias:** the tendency to test hypotheses exclusively through direct testing
- contrast effect:** the enhancement or diminishment of a weight or other measurement when compared with recently observed contrasting object.
- disconfirmation bias:** the tendency for people to extend critical scrutiny to information which contradicts their prior beliefs and accept uncritically information that is congruent with their prior beliefs.
- endowment effect:** the tendency for people to value something more as soon as they own it.
- hyperbolic discounting:** the tendency for people to have a stronger preference for more immediate payoffs relative to later payoffs, the closer to the present both payoffs are.
- illusion of control:** the tendency for human beings to believe they can control or at least influence outcomes which they clearly cannot.
- impact bias:** the tendency for people to overestimate the length or the intensity of the impact of future feeling states.
- information bias:** the tendency to seek information even when it cannot affect action
- just-world phenomenon:** the tendency for people to believe the world is "just" and so therefore people "get what they deserve."
- loss aversion:** the tendency for people to strongly prefer avoiding losses than acquiring gains (see also sunk cost effects)
- mere exposure effect:** the tendency to express undue liking for things merely because they are familiar with them.
- color psychology:** the tendency for cultural symbolism of certain colors to affect affective reasoning.
- planning fallacy:** the tendency to underestimate task-completion times.
- pseudocertainty effect:** the tendency to make risk-averse choices if the expected outcome is positive, but risk-seeking choices to avoid negative outcomes.
- rosy retrospection:** the tendency to rate past events more positively than they had actually rated them when the event occurred.
- selective perception:** the tendency for expectations to affect perception.
- status quo bias:** the tendency for people to like things to stay relatively the same.
- Von Restorff effect:** the tendency for an item that "stands out like a sore thumb" to be more likely to be remembered than other items.
- Zeigarnik effect:** the tendency for people to remember uncompleted or interrupted tasks better than completed ones.

# Probability & prediction biases

**anthropic bias:** the tendency for one's evidence to be biased by observation selection effects.

**availability error:** the distortion of one's perceptions of reality due to the tendency to remember one alternative outcome of a situation much more easily than another.

**clustering illusion:** the tendency to see patterns where actually none exist

**conjunction fallacy:** the tendency to assume that specific conditions are more probable than general ones.

**gambler's fallacy:** the tendency to assume that individual random events are influenced by previous random events — "the coin doesn't have memory"

**hindsight bias:** sometimes called the "I-knew-it-all-along" effect, is the inclination to see past events as being predictable.

**illusory correlation:** beliefs that inaccurately suppose a relationship between a certain type of action and an effect.

**Observer-expectancy effect:** when a researcher expects a given result and therefore unconsciously manipulates an experiment or misinterprets data in order to find it. (see also subject-expectancy effect)

**positive outcome bias:** a bias in prediction in which people overestimate the probability of good things happening to them. (see also wishful thinking and valence effect)

**primacy effect:** the tendency to weigh initial events more than subsequent events

**recency effect:** the tendency to weigh recent events more than earlier events (see also peak-end rule)

# Airmanship: Capstones

## Motivational Judgment

- Pilots base decisions with tendencies to use less than purely rational information, as defined by society.
  - **Immediate gratification**: ego, adventure, commitment, duty, social pressure.
  - **Emotional arousal**: worry, fear, stress, anxiety, euphoria.
  - **Long term biases**: risk-taking, personality factors (fear of failure, defensiveness).
- Requires
  - Awareness of biasing factors,
  - Will to suppress these factors.

# Airmanship: Putting it all together

## Decision Making

- Some situations, such as rope breaks or stalls, require a pilot to respond immediately using established procedures with little time for detailed analysis.
- Traditionally, pilots have been well trained to react to emergencies, but are not as well prepared to make decisions requiring a more reflective response.
- During a flight, there is time to examine any changes that occur, gather information, and assess risk before reaching a decision. These steps are the decision making process.

# Airmanship: Putting it all together

## Decision Making

- Define the change
  - **Detect** a change has occurred or that an expected change did not occur.
    - Perceived first by the senses, then is distinguished through insight and experience.
    - Objective analysis of all available information, are used to determine the exact nature and severity of the problem.
  - **Estimate** the impact of this change on the flight.

# Airmanship: Putting it all together

## Decision Making

- Define the change
  - One critical error — incorrectly defining the problem.
  - Fixating on a problem that does not exist can divert attention from important tasks.
    - The pilot's failure to maintain an awareness of the circumstances regarding the flight now becomes the problem.
  - Once an initial assumption is made about the situation — check and recheck.

# Airmanship: Putting it all together

## Decision Making

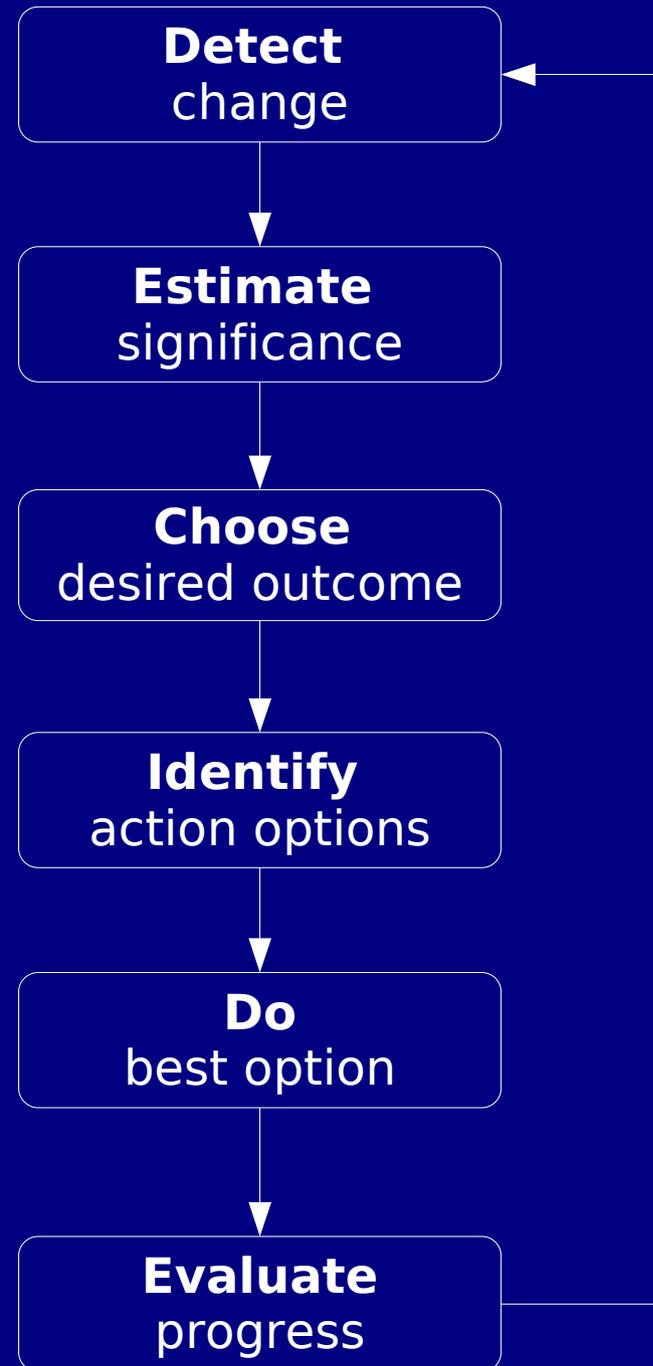
- Choosing an action
  - **Choose** a desired outcome.
    - This may require revision of flight plans.
  - **Identify** the actions that may be taken to resolve the situation in the time available.
  - Risks assessed before deciding on a response to the situation.

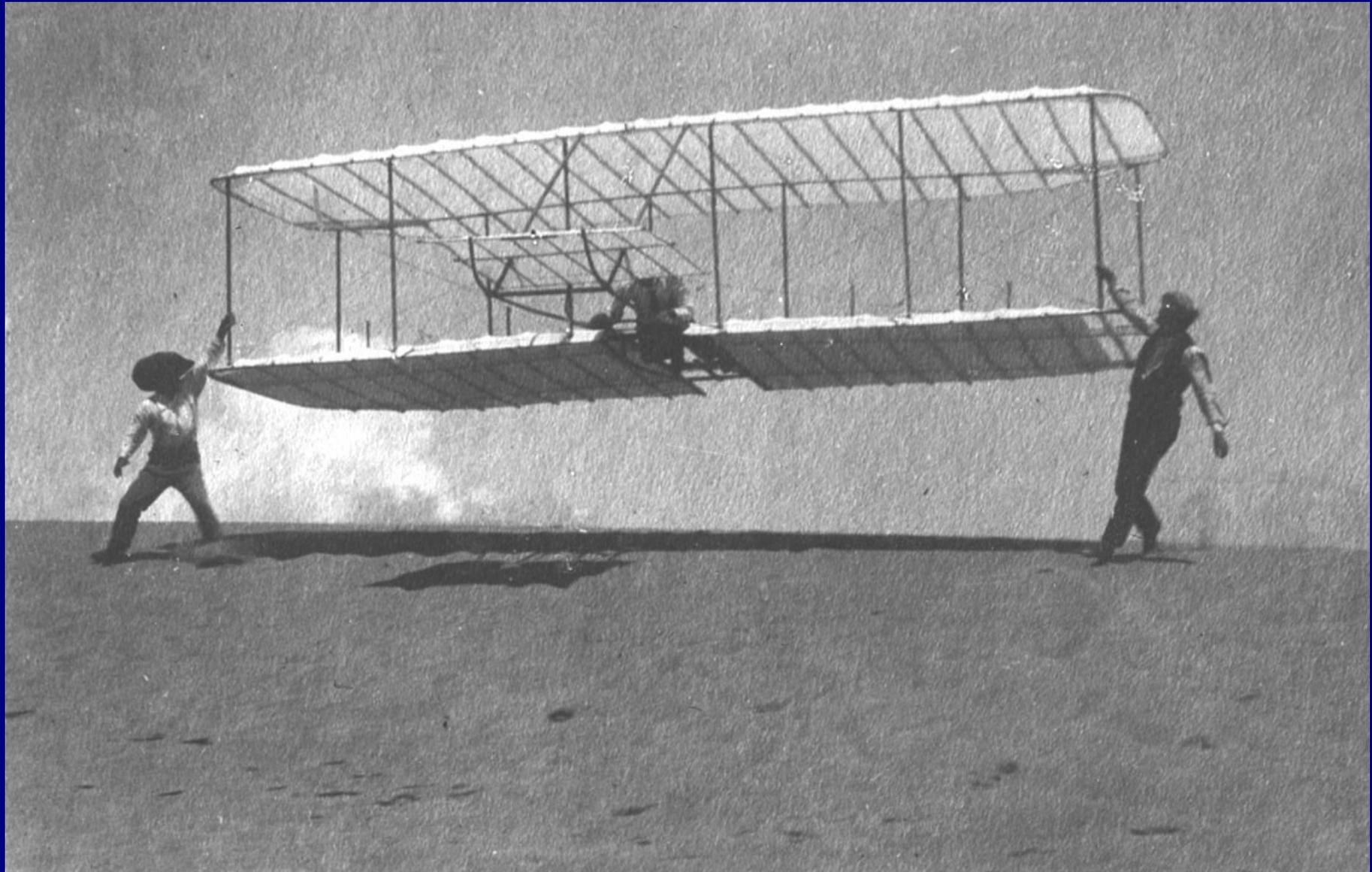
# Airmanship: Putting it all together

## Decision Making

- Implement and evaluate
  - Do the action
  - Decision reached and an action implemented
    - the decision-making process is not complete!
  - Plan ahead and determine how the decision could affect the rest of the flight.
  - As the flight progresses, evaluate the outcome of the decision to ensure that it is producing the desired result.

# DECIDE





*If you are looking for perfect safety,  
you will do well to sit on a fence and watch the birds.*  
— Wilbur Wright

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“There are old pilots,  
there are bold pilots,  
but there are no old, bold pilots.”