

Soaring Safety Summit

Decision Making, Judgment
& Airmanship

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“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.”

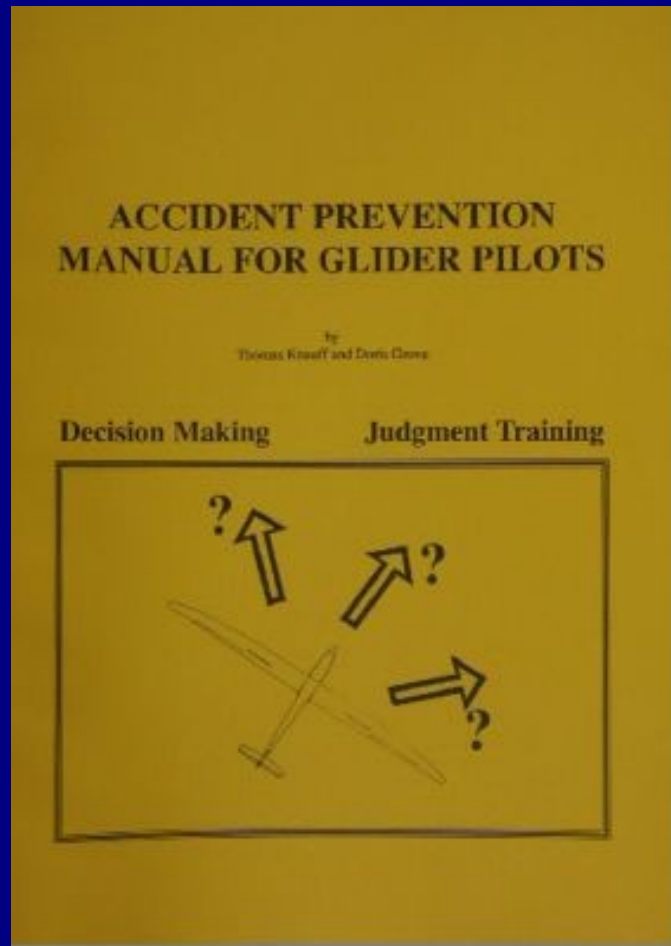
Pilot Error

- 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

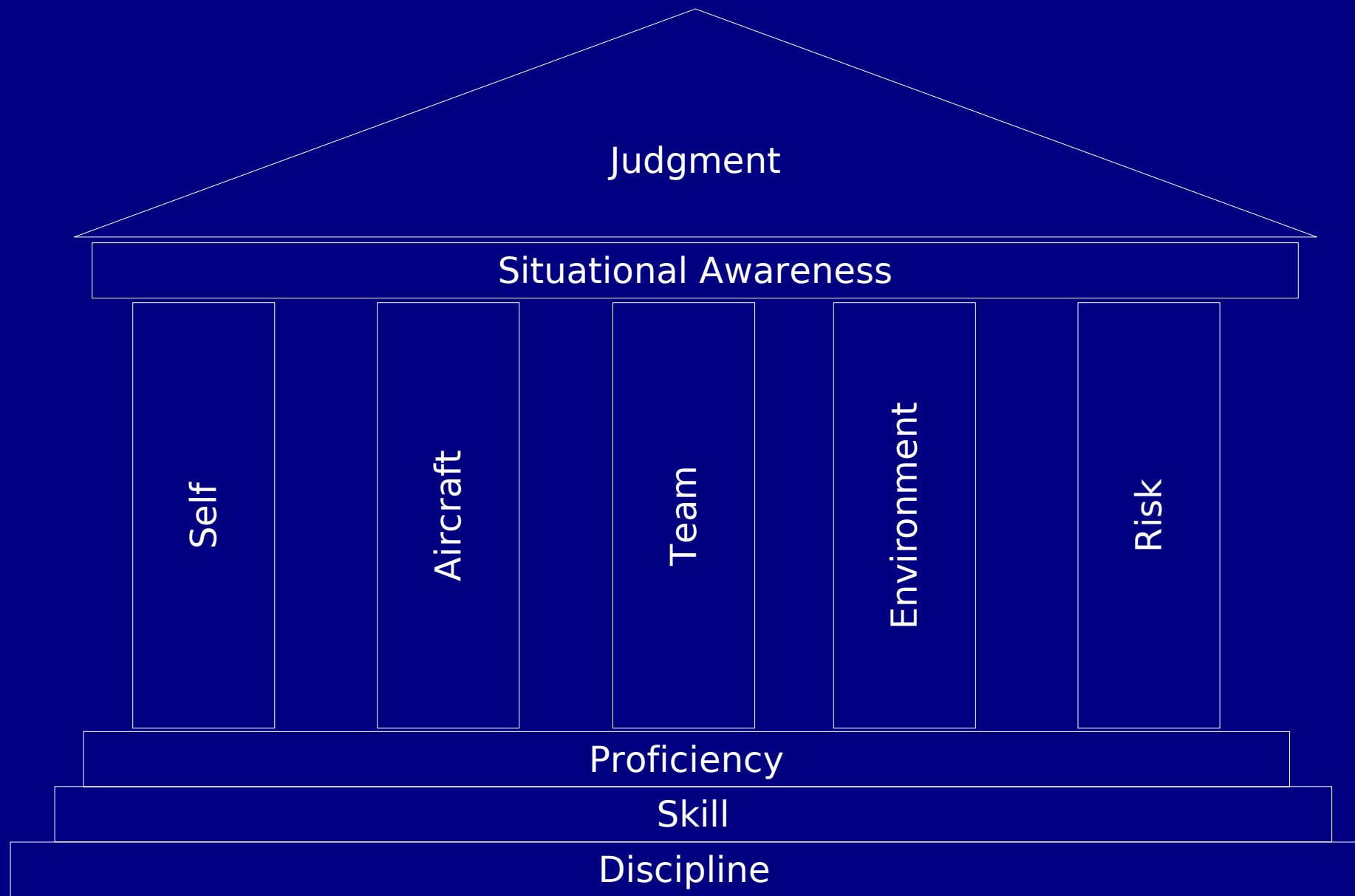


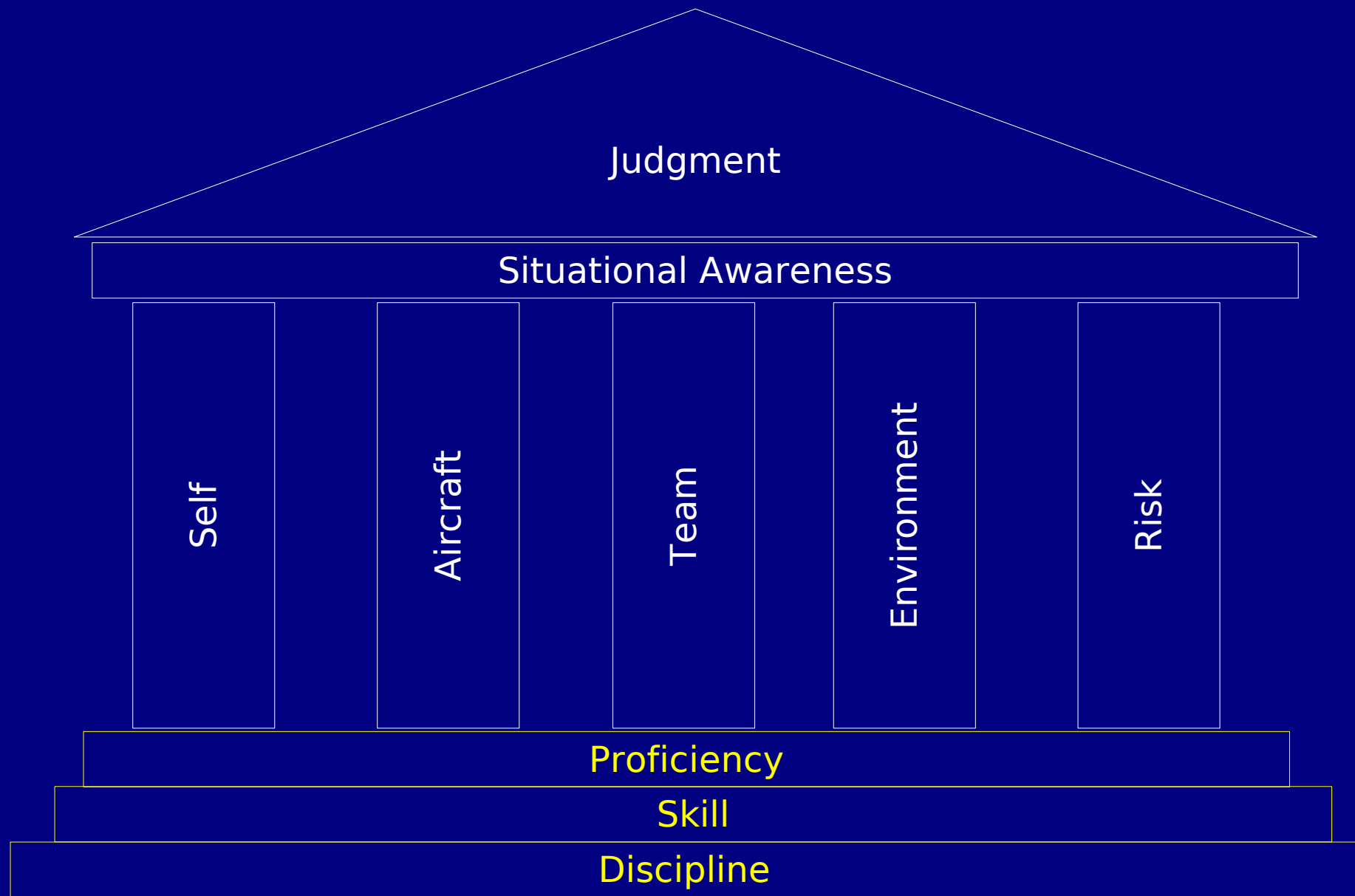
Redefining Airmanship

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

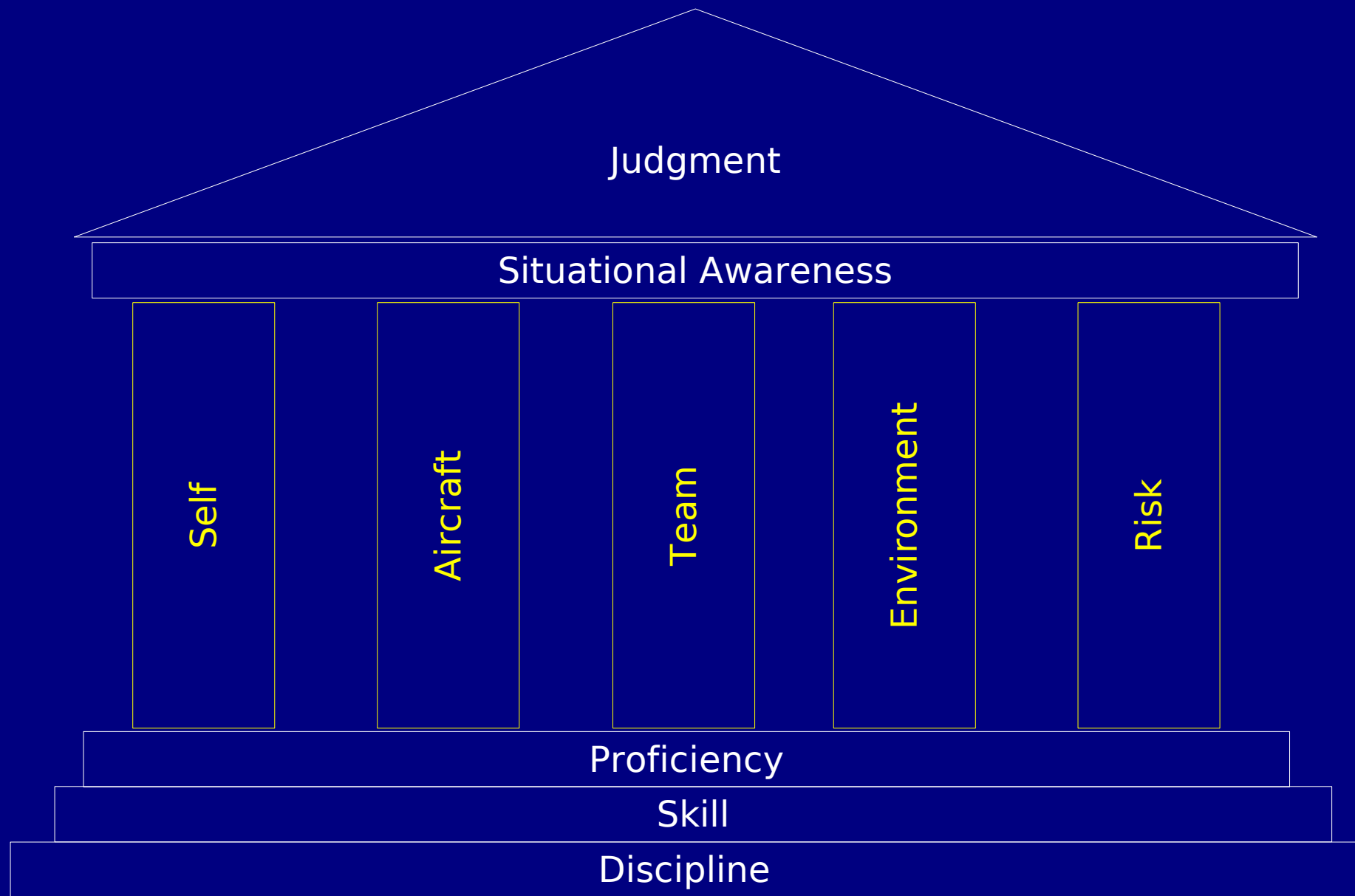
- **Ability and willpower** to safely employ an aircraft within operational, regulatory, organizational, and common sense guidelines — unless emergency demands otherwise.
- Ability and willpower imply a conscious act.
- Compliance: POH, FARs, club rules.
- Special circumstances.
- Rogue Aviator:
 - *Flight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

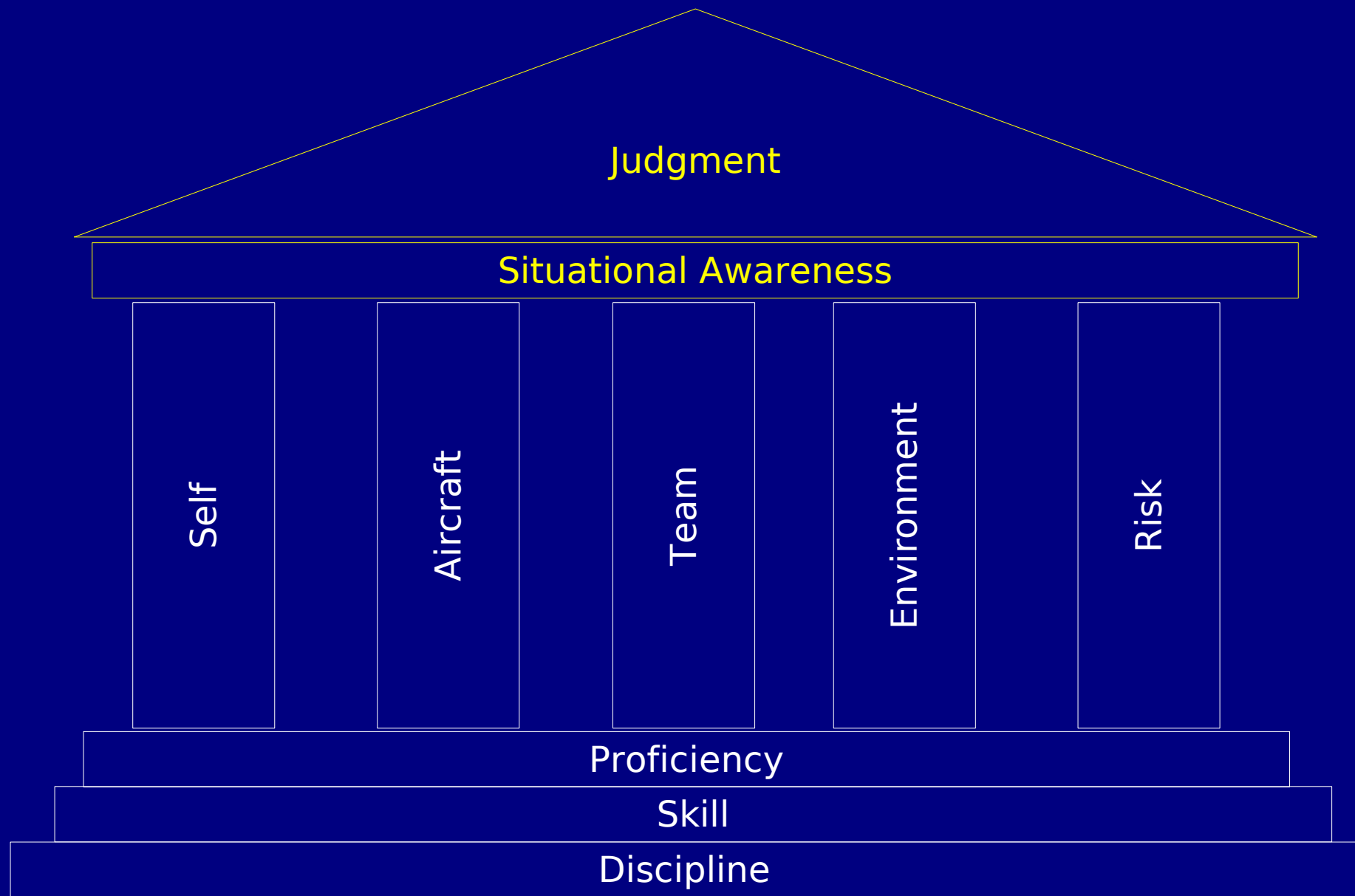
Know your environment

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

Airmanship: Pillars

Know your risk

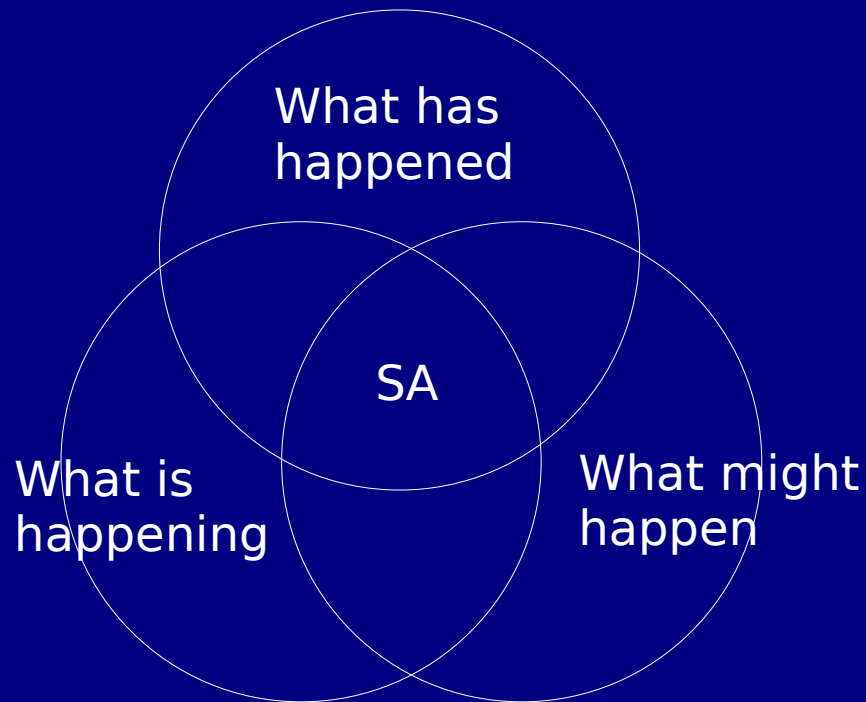
- Reason for risk: **no risk, no opportunity.**
- Risk identification: different levels of risk.
- Risk to discipline.
- Risk to skill and proficiency.
 - Problem: demands > capabilities.
- Risk to knowledge.
 - Attitude to learning
- Risk to situational awareness and judgment.



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

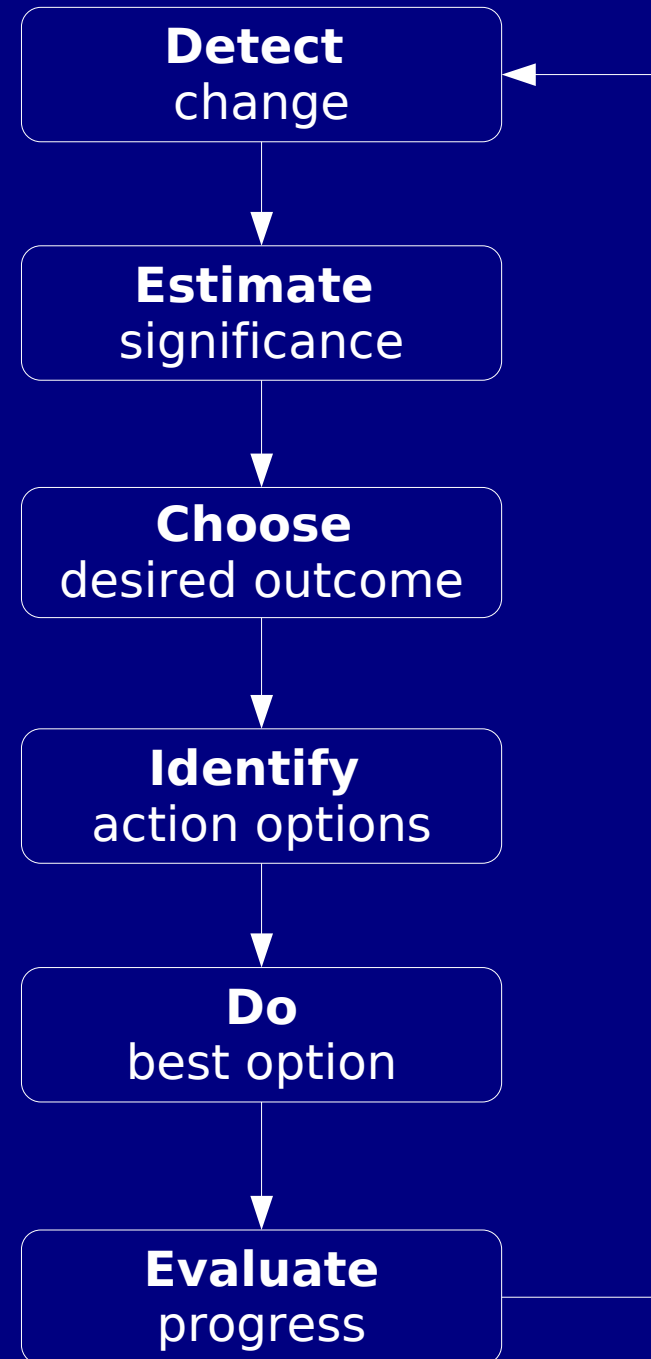
- Choosing an action
 - **Choose** a desired outcome.
 - This may require revision of flight plans.
 - **Identify** the actions that may be taken to resolve the situation in the time available.
 - Risks assessed before deciding on a response to the situation.

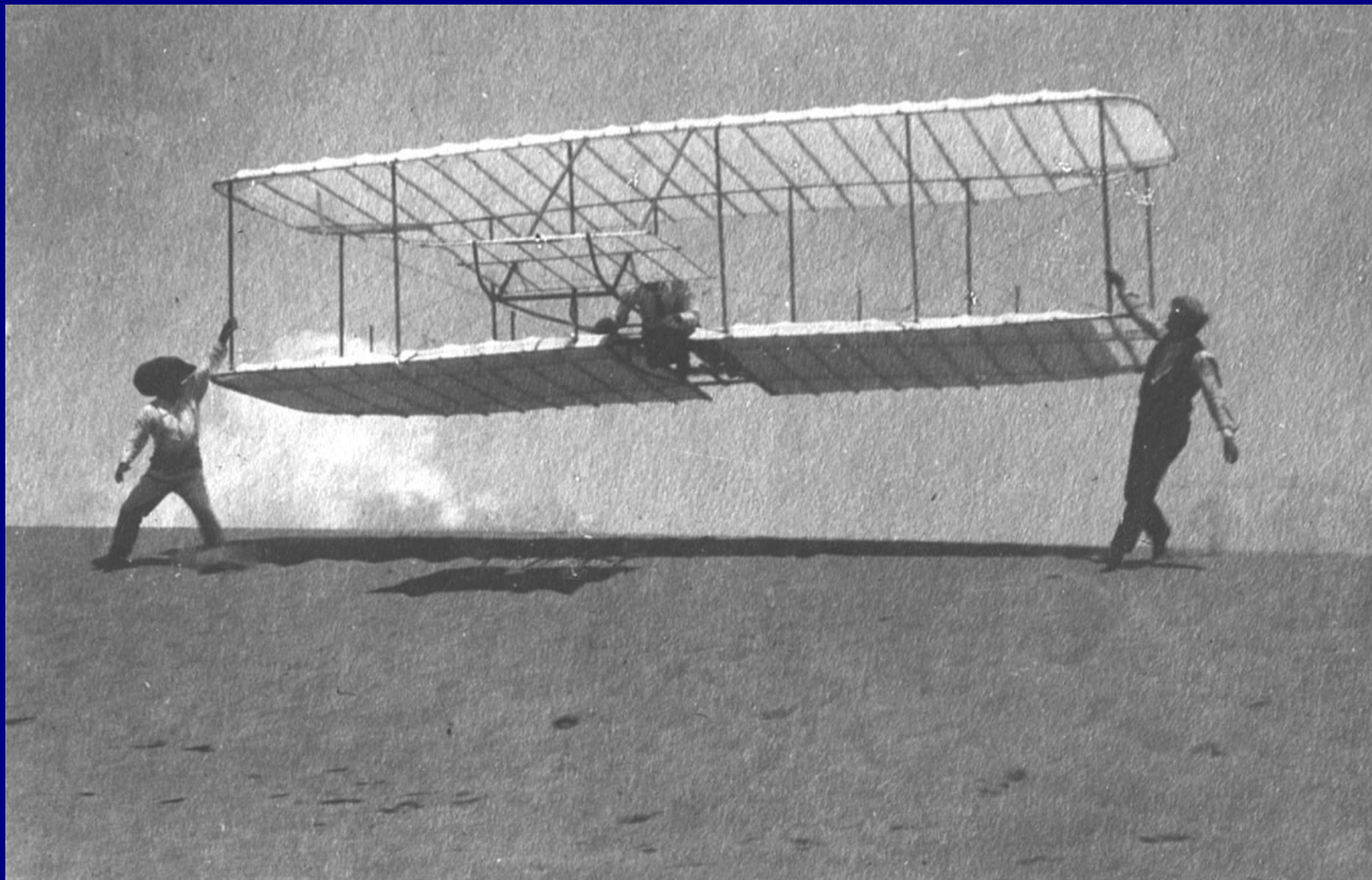
Airmanship: Putting it all together

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.”