

The Aircraft Was Almost Never The Problem

Review of the FAA Flight Standards Service, *Pilot's Handbook of Aeronautical Knowledge*, FAA-H-8083-25 (2003 edition, 353 pp.)

TLDR / 80-20

Roughly 75% of aviation accidents are human-factors related, and the handbook is organised around that number.

The physics chapters exist to make the judgement chapters possible. The real subject is a pilot deciding under load.

The Keys

The number the book is built on

- **Three in four accidents are human factors.** Not mechanical failure, not weather as such — an action or decision by the pilot caused or contributed to the outcome.
- **"Pilot error" is named as an inadequate label.** It describes where the accident happened rather than why, which is why the handbook teaches a process instead.
- **ADM is that process:** a systematic approach to consistently determining the best course of action for a given set of circumstances, taught like a manoeuvre.
- **The poor judgment chain has two principles.** One bad decision leads to another, and a growing string of them reduces the alternatives still available for safe flight.
- **So the intervention is breaking the chain,** not avoiding the first mistake. The handbook assumes mistakes and targets the propagation instead.
- **Fitness is preflighted like the aircraft.** Pilots check airworthiness thoroughly and skip themselves — hence a personal checklist and the I'M SAFE checklist.
- **Personal minimums are encouraged above the legal ones.** A pilot may set weather limits higher than 14 CFR part 91 requires and treat those as binding.
- **Fixation is the named failure mode.** Fatigue, stress and overload make a pilot lock onto one item; many accidents begin as a minor gauge problem.

Load factor, in numbers

- **Bank angle buys G steeply and non-linearly.** About 60° is the practical maximum for a coordinated level turn in an average general aviation aircraft.
- **Ten more degrees costs a whole G.** Going from 60° to 70° adds roughly 1 G, bringing a light aircraft close to its established yield point.
- **Past 80° the load exceeds 6 G,** which is the limit load factor of an aerobatic aircraft — and most light aircraft are not aerobatic.
- **Any aircraft can stall at any airspeed.** The stall is an angle-of-attack event; airspeed only correlates with it under one specific load condition.

- **Load factor rises as the square of the speed ratio.** Stalling at 1.7 times normal stall speed produces 2.89 G; at 112 knots in that aircraft, 4 G.
- **The stall is a balance failure, not just a lift failure.** When wing lift and the download on the tail both cease, the aircraft pitches down about its centre of gravity.
- **Recovery costs altitude** even though it is automatic — angle of attack reduces, speed builds, lift returns, and considerable height is gone by then.
- **Improper spiral recovery causes in-flight structural failure.** The spiral develops so gradually that the danger is in the pull-out, not the entry.

Turning, trimmed and untrimmed

- **A slipping turn and a skidding turn fail opposite ways.** A skid means the rate is too great for the bank; the fix is less rate, more bank, or both.
- **Bank angle must vary with airspeed to hold a rate.** At 400 mph a standard-rate turn of 3° per second needs about 44° of bank.
- **At that bank only 79% of lift holds you up.** The rest is turning the aircraft, so altitude is lost unless angle of attack increases to compensate.
- **No aircraft can be flown hands-off indefinitely.** All are affected by spiral divergence to some degree, however stable they are in every other axis.
- **Seat pressure is the practical G meter.** Control forces are not a reliable index because leverage and balanced surfaces differ between aircraft types.
- **Weight and balance is per-airframe, not per-model.** Modifications and equipment changes mean the AFM/POH empty weight may not match the aircraft in front of you.

Performance is a calculation, not a feel

- **The worst takeoff is a combination.** High gross weight, high altitude, high temperature and unfavourable wind compound rather than add.
- **Density altitude is the single variable that hides the others.** Pressure altitude and temperature together define it, and it drives distance directly.
- **Certification is not permission.** An aircraft certified to a maximum gross takeoff weight "will not safely take off with this load under all conditions."
- **Predict the distance regardless of runway length.** The handbook insists on computing takeoff distance from the AFM/POH even when the runway is obviously long enough.
- **Manufacturer data is not standardised.** Some give tables, some give graphs, and sample loading problems are guidance only — each aircraft must be treated separately.
- **Performance goals are mutually opposed.** High speed against short landing distance, long range against payload, climb rate against fuel economy — specialisation follows.
- **Multi-engine adds a second gate.** Takeoff weight must allow the one-engine-inoperative climb gradient to be met, which can bind before runway length does.

AI's Take

- **This is a regulator's book, and it reads like one.** It states what a pilot must know to be examined, with authority substituting for derivation throughout.
- **Its one strong empirical claim carries the whole structure.** The 75% human-factors figure justifies every chapter that is not about metal and air.
- **The load-factor numbers are the most useful pages,** because they convert an abstract warning into arithmetic a pilot can do before the manoeuvre rather than during it.
- **"Any airplane may be stalled at any airspeed"** is the single sentence most worth carrying out of the book, and it contradicts how most people hold the concept.
- **It never explains, it only asserts.** Where Anderson derives lift from conservation laws, the handbook states the result — fine for operating, useless for reasoning past the chart.
- **The edition is a real problem.** This is the 2003 revision, superseded by 8083-25C, and the file's own metadata says "File 1 of 4" — treat coverage as partial.
- **The transferable idea is the poor judgment chain.** Design the intervention for the second and third errors, because the first one is going to happen.
- **The second is preflighting yourself.** A checklist applied to the operator rather than the machine, which almost no other technical field institutionalises.
- **Read Chapters 3, 9 and 16 and skip the rest** unless you are sitting the exam. Aerodynamics of flight, performance, and decision making carry the content.