



STALL IF YOU WANT TO **(but not if you don't)**

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How do we improve aviation safety? Here's one approach:



I DON'T KNOW HOW
TO DO STATISTICS BUT
IT DOESN'T MATTER
BECAUSE I DIDN'T
HAVE DATA.





Okay, here's some data:

**Stalls figured into at least 990 light airplane accidents between 2002-2011.
That's an average of *8 per month*.**

204 resulted from other emergencies:

- 71 (43 fatal) fuel mismanagement**
- 64 (26 fatal) mechanical failures**
- 69 (38 fatal) unexplained power losses**

Topic for another seminar!



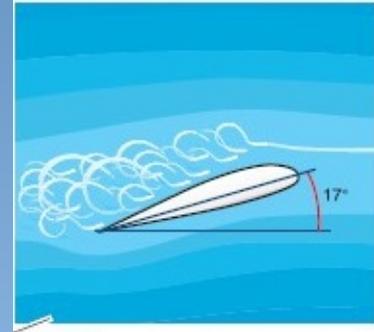
More data! More, more, more!

“Unprovoked” stalls

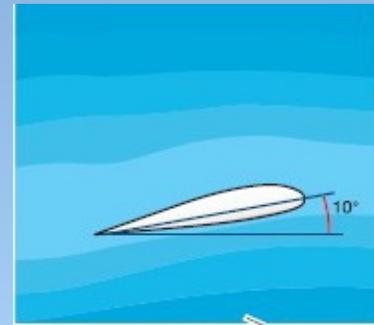
- caused *at least* 786 airplane accidents between 2002-2011
- 346 (44%) were fatal – twice the overall rate in fixed-wing GA accidents
- killed *at least* 598 pilots and passengers
- most looked *nothing* like deliberate stall/recovery practice

Review:

**Stall = Exceeding critical AOA.
Period. Nothing else.**

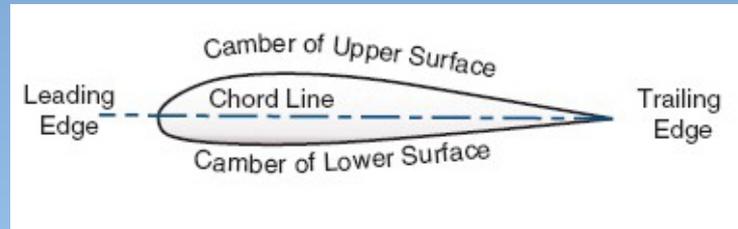


**AOA = Angle between chord
line and relative wind**



Review:

**Chord line's pretty intuitive
(but can change – washout, flaps)**



What about relative wind?



The “relative wind”

... is defined by the airplane’s motion through the air

not the air’s movement over the earth!

So an airplane really can be stalled at any

- airspeed
- attitude
- power setting

If you don't believe me,
just ask Dave.





This doesn't mean ...

that an airplane will stall at any combination of airspeed, attitude, and power setting!

But the more abrupt the control inputs, the faster AOA will change.

So where do stall accidents happen?



POP QUIZ:

What percentage of stall accidents occur while intentionally practicing stalls?

- **None**
- **2%**
- **5%**
- **15%**



ANSWER:

Just 18 accidents in 10 years – 2.3% of the total – resulted from failures to recover from intentional stalls or spins.

Half were fatal.

Only “legitimate” aerobatics (8 total, 7 fatal) and IFR flight in actual IMC (16 total, 18 fatal) caused fewer.



Practicing stalls is safe because

- the pilot expects the stall
- attention's paid to coordination
- there's plenty of altitude to recover even if the initial reaction isn't perfect
- if a CFI's on board, (s)he *should* know how to recover from an unintended spin

In most stall accidents, ***NONE*** of these apply!



Time for a few equations:

(1) Unexpected stall + low altitude = Trouble

(2) Uncoordinated flight + unexpected stall
+ low altitude = ***BIG TROUBLE!***

This helps explain why ...



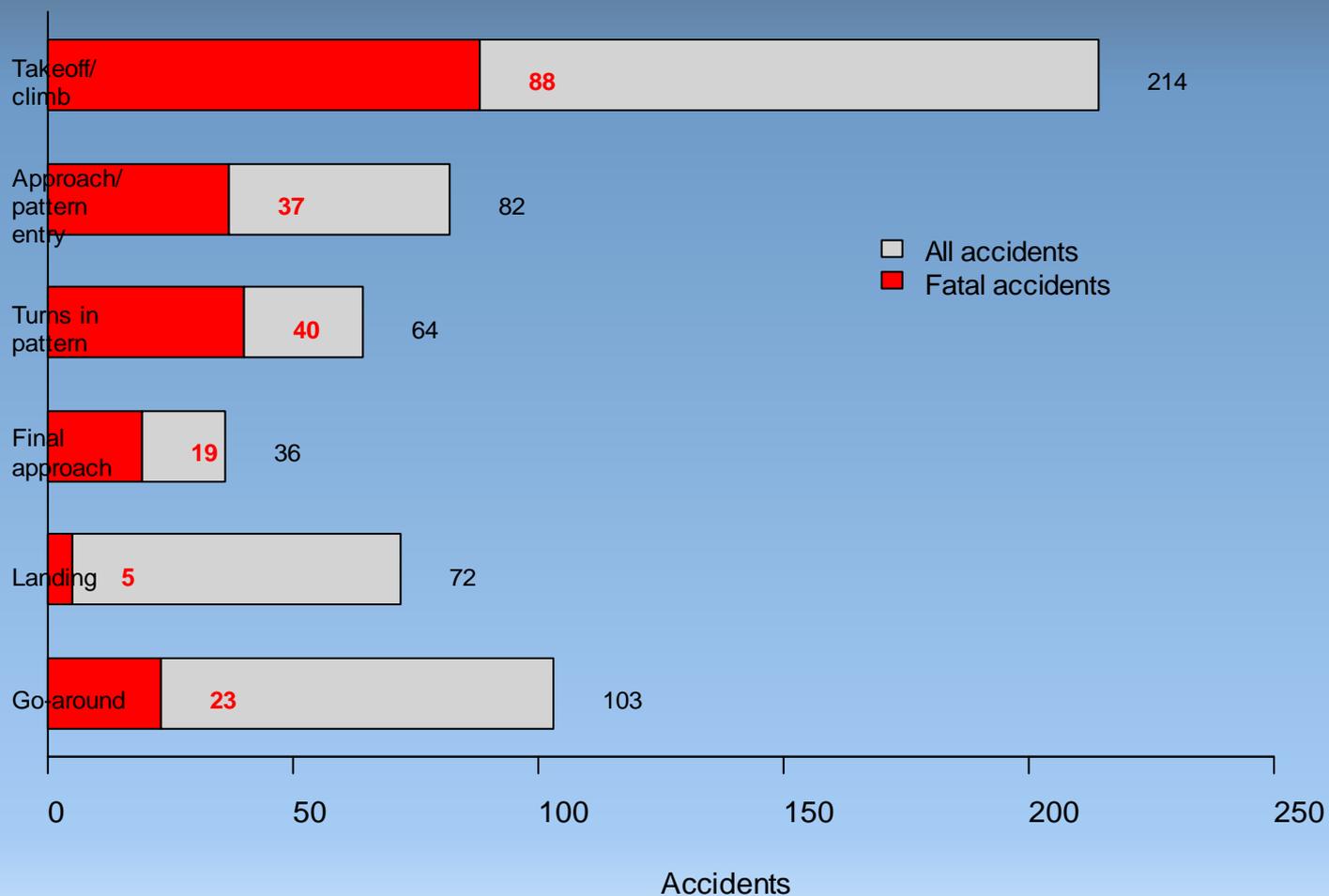
More than 70% of all stall accidents happened in or around the traffic pattern (571 of 786).

These included more than 60% of the fatal accidents (212 of 346).

Other kinds of aggressive low-altitude maneuvering account for most of the rest.

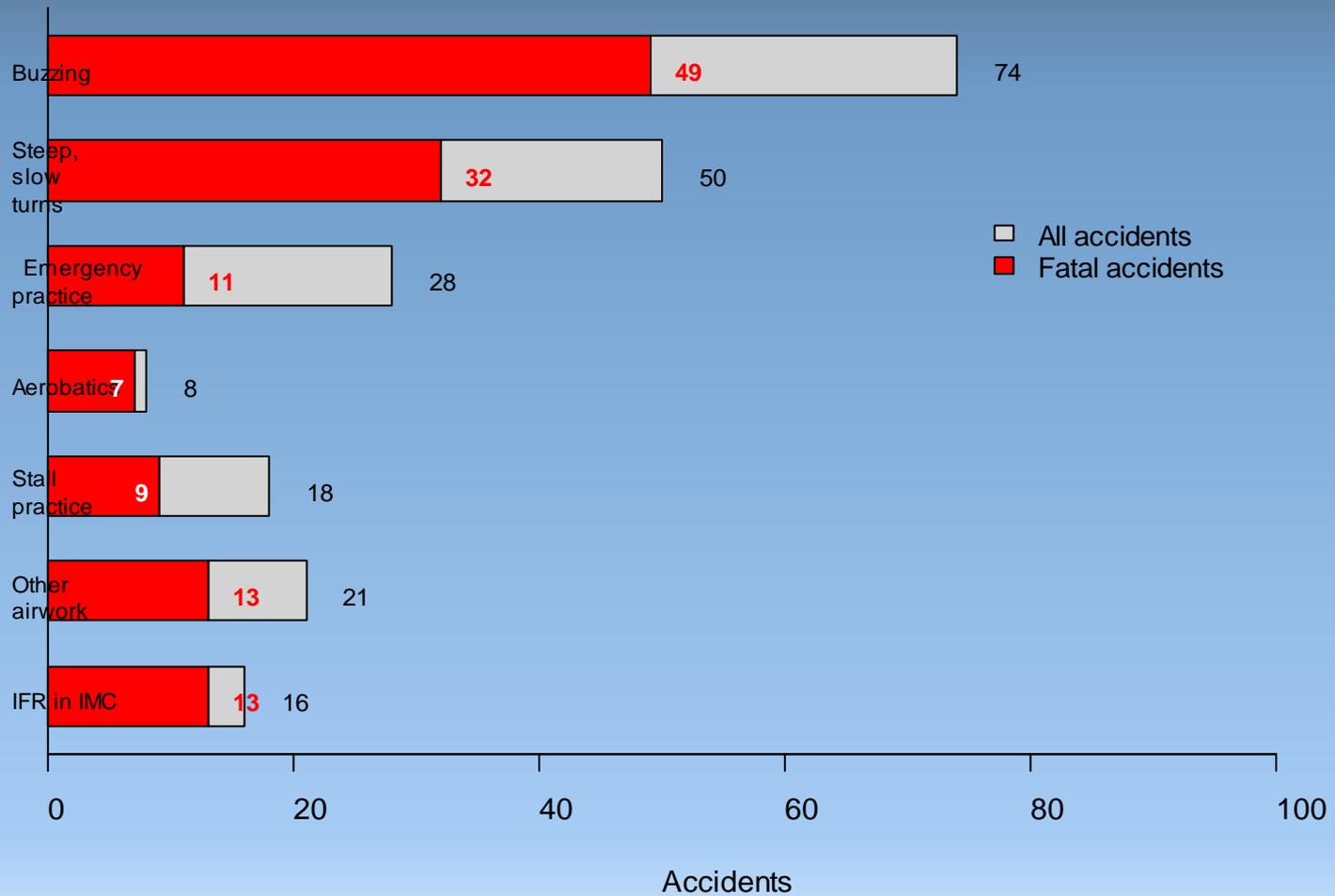


Traffic pattern stalls





Stall accidents outside





Departure Stalls:

Weight, density altitude, downwind/uphill departures, and short/obstructed fields all come into play – but

- Most common reason is premature rotation and excessive back pressure**
- Configuration errors (flaps, trim) may not be correctable in time remaining**
- Late abort may be safer than trying to make the airplane fly before it's ready**



NYC06FA162 – Cessna 310D

Sutton, West Virginia 6-30-2006

3,800-hour private pilot, 460 hours ME

**Lifted off halfway down 4,000-foot
runway in “tail-low” attitude**

**Banked and drifted left, then right; began
“wobbling” and crashed into trees**

No evidence of mechanical failure

**Fuselage consumed by fire. Pilot and
passenger both killed.**



LAX06FA005 – Champion 8KCAB

Oroville, California 10-10-2005

6,600-hour CFI/ATP, 924-hour private pilot

Curriculum included “unusual attitudes”

Climbed at 45-degree pitch angle to 650 agl

Entered steep left bank and “fell out of sky”

**Almost recovered to level attitude before
impact**

Airplane consumed by fire. Both killed.



Stalls during go-arounds:

Absolutely crucial basic maneuver often neglected after the checkride

- **Rapid changes in power, attitude, and configuration**
- **Sequence is crucial: flaps first, or gear?**
- **Likely too much nose-up trim to climb**
- **Timely and sufficient rudder pressure essential to prevent yaw and roll**
- **No second thoughts: Once initiated, *commit* to it!**



LAX04FA241 – Cessna 337

Carson City, Nevada 6-16-2004

1,700-hour ATP, 600 hours make/model, all flight time within preceding two years

Entered left traffic for runway with published right traffic, then lined up with taxiway

Initiated go-around, climbing left turn

Stalled at about 1,000 agl, spun into ground

Gear was still down in wreckage

Airplane consumed by fire. Both killed.



CHI06FA186 – Cirrus SR22

Edgewater, Maryland 7-11-2006

2,750-hour private pilot, 170 make/model

Crossed threshold at 150-175 agl, “dove for runway”

Still 75 agl halfway down 2,500-foot runway

Engine noise increased, but “not to full power”; airplane pitched up, banked hard to the left, and crashed into trees

Flaps were still fully extended

Cabin crushed. Pilot killed.



Pattern entry and approach:

Great potential for distraction looking for traffic while slowing airplane, establishing ground references for pattern, running checklists, etc.

- Abrupt reaction to perceived conflicting traffic can precipitate stall at pattern altitude**
- S-turns or 360s for spacing require attention**
- Courtesy on the parts of those in pattern as well as those entering will smooth flow!**
- Most tower controllers aren't pilots! ATC can unintentionally aggravate the situation**



ATL04LA158 – Pitts S-1

Durham, North Carolina 7-17-2004

356-hour rec pilot, at least 18 make/model

Bounced twice, then went around on first attempt to land at private airpark

On second attempt, put in “hard slip” to left, then nosed up and spun in exiting slip

Crashed nose-low. Pilot was killed.



MIA08FA141 – Socata TBM-700

Kennesaw, Georgia 7-15-2008

975-hour private pilot with extensive high-performance experience

Inbound on IFR flight plan, reported final

Tower controller requested S-turns to allow prior departures

Cleared to land after half an S-turn; witnesses saw airplane “do wingover” and roll inverted

Crashed in vertical nose-down attitude

Airplane consumed by fire. Pilot killed.



Simulated emergencies:

Should not become REAL ones!!

- Practice procedures at *safe altitudes* (especially the “impossible turn”!)
- Identify a suitable emergency landing site within gliding distance before retarding power
- Break off the maneuver *before* it’s too late to reach your touchdown spot!
- **LEAVE YOURSELF A WAY OUT!!**



IAD03FA050 – Beech A36 Jackson, Ohio, 4-26-2003

BPPP training program at KCMH

**7,300-hour CFI, 500-800 make/model;
405-hour owner with 327 make/model**

**CFI liked to teach return to runway
after power loss at 900-1,000 agl**

**Stalled into trees in “continuous right
bank” with engine at full power**

Fuselage crushed. Both pilots killed



LAX06FA087 – Cirrus SR20

Lancaster, California, 1-9-2006

1,050-hour CFI with 34 make/model; 430-hour helicopter pilot, 58 make/model

ATC approved CFI request for two “engine out ... and turn back to land the other way”

First landing aborted after “significant” loss of altitude during turn; asked to try again

Seen to turn left and “spin into ground”

Fuselage destroyed by impact. Both killed.



SEA06FA126 – Pilatus PC-12

Big Timber, Montana, 6-24-2006

3,200-hour CFI was former Pilatus company pilot and current Air Force Reservist; 725-hour owner, 140 make/model, “very careful”

Advised would do turnback after simulated power loss; winds down runway @ 17G23KT

Saw steep climb, hard bank to right, nose dropped, “appeared uncoordinated”

Hit right wingtip, engine attempting recovery

Consumed by post-impact fire. Both killed.



Buzz jobs:

High-speed, low-altitude pass, sharp pull-up

- **Classic set-up for accelerated stall!**
- **Rapid increase in AOA exceeds critical angle at much higher than usual airspeed**
- **Break is sudden, violent, w/little warning**
- **Insufficient altitude to recover**
- **Nose-low impact at high speed catastrophic**
- **Showing off for folks on ground?**



CHI07LA288 – Cessna 172 Union Star, Missouri, 1-9-2006

17-year-old, 23-hour student pilot flying solo to practice ground ref, steep turns, stalls

Made repeated dives and pull-ups over neighborhood 10 miles from practice area

Pitched up in steep left bank at 150-200 agl

Wing dropped; nose dropped “straight down”; left wing hit power line

Cabin destroyed by fire. Pilot killed.



WPR09FA255 – Beech 95-A55

Minden, Nevada, 5-9-2009

4,700-hour private pilot, aircraft broker

Took four passengers on sightseeing flight

Made repeated passes at 200-300 agl over people working on a neighboring ranch

Sudden steep climbing left turn; nose dropped, rolled to 90 degrees bank

Engines “running perfectly throughout”

Fuselage crushed. All five killed.





“Moose stalls”:

Tight turns at low altitude and airspeed are another recipe for accelerated stalls!

- Often to look at (or for) something on ground
- Remember: Bank angle increases load factor!
- Increased load requires increased lift – more airspeed and/or greater AOA
- Adds back pressure trying to tighten turn and maintain altitude without increasing speed
- Coordinated turning stalls may be unfamiliar
- Uncoordinated turning stall = *SPIN*.



ANC10FA076 – Piper PA-11 Willow, Alaska, 8-24-2010

230-hour private pilot, make/model unknown

**Seen flying 100 feet above river with no
indication of abnormality**

**Witnesses heard something “flap the water”,
passing pilot found wreckage in flames**

Family said pilot, pax scouting for wildlife

Moose tracks found around accident site

Near-vertical impact, then fire. Both killed.



IAD05FA067 – Cessna 172S

Brooklyn, New York, 5-21-2005

1,930-hour CFI taking 3 pax for intro flight

Took off 139 pounds over maximum gross

42 witnesses saw it maneuvering at low altitude over Coney Island beachfront

Disappeared from radar at 300 agl, 60 knots

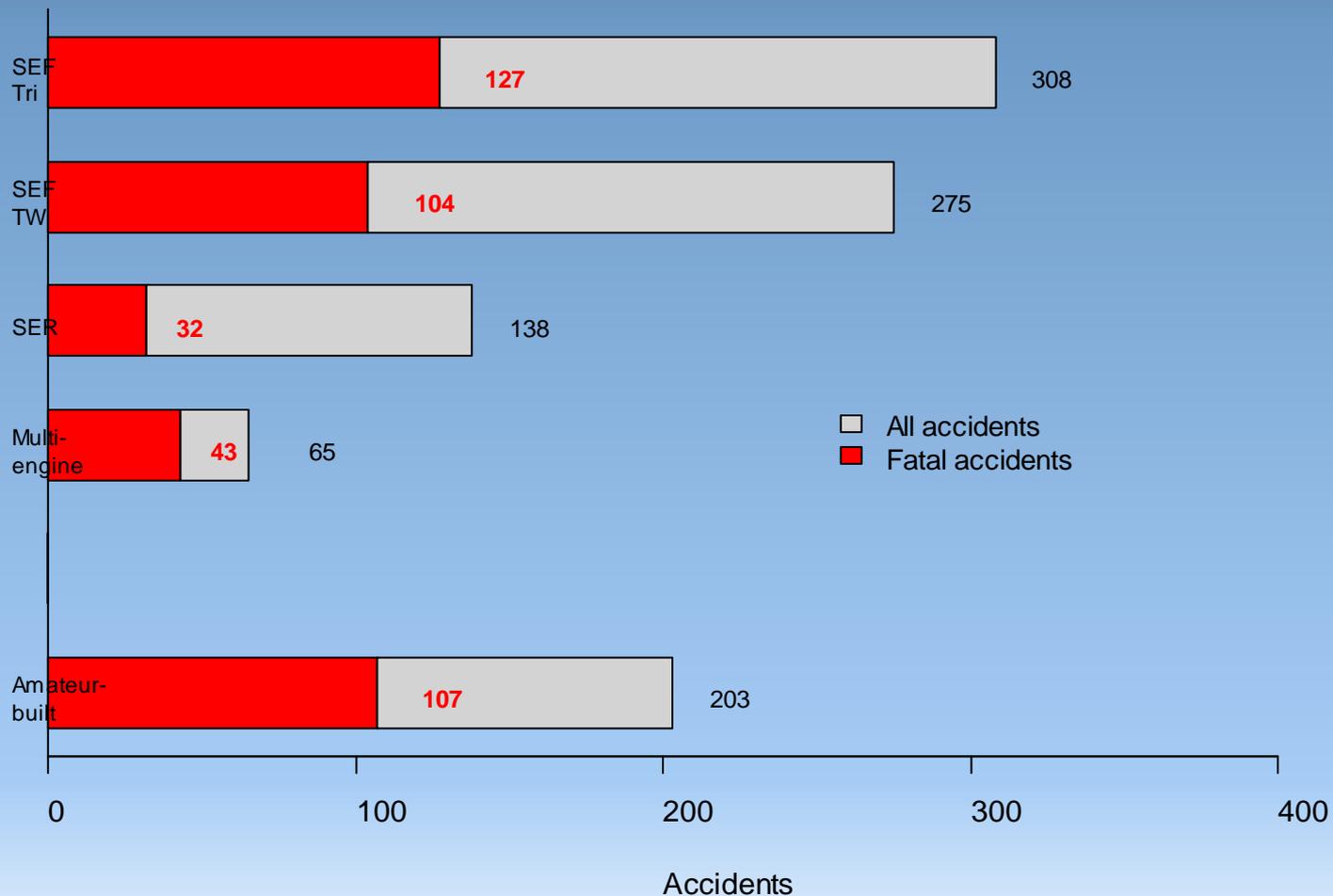
Banked left and nose dropped

Cabin crushed. All four killed.

The usual suspects:

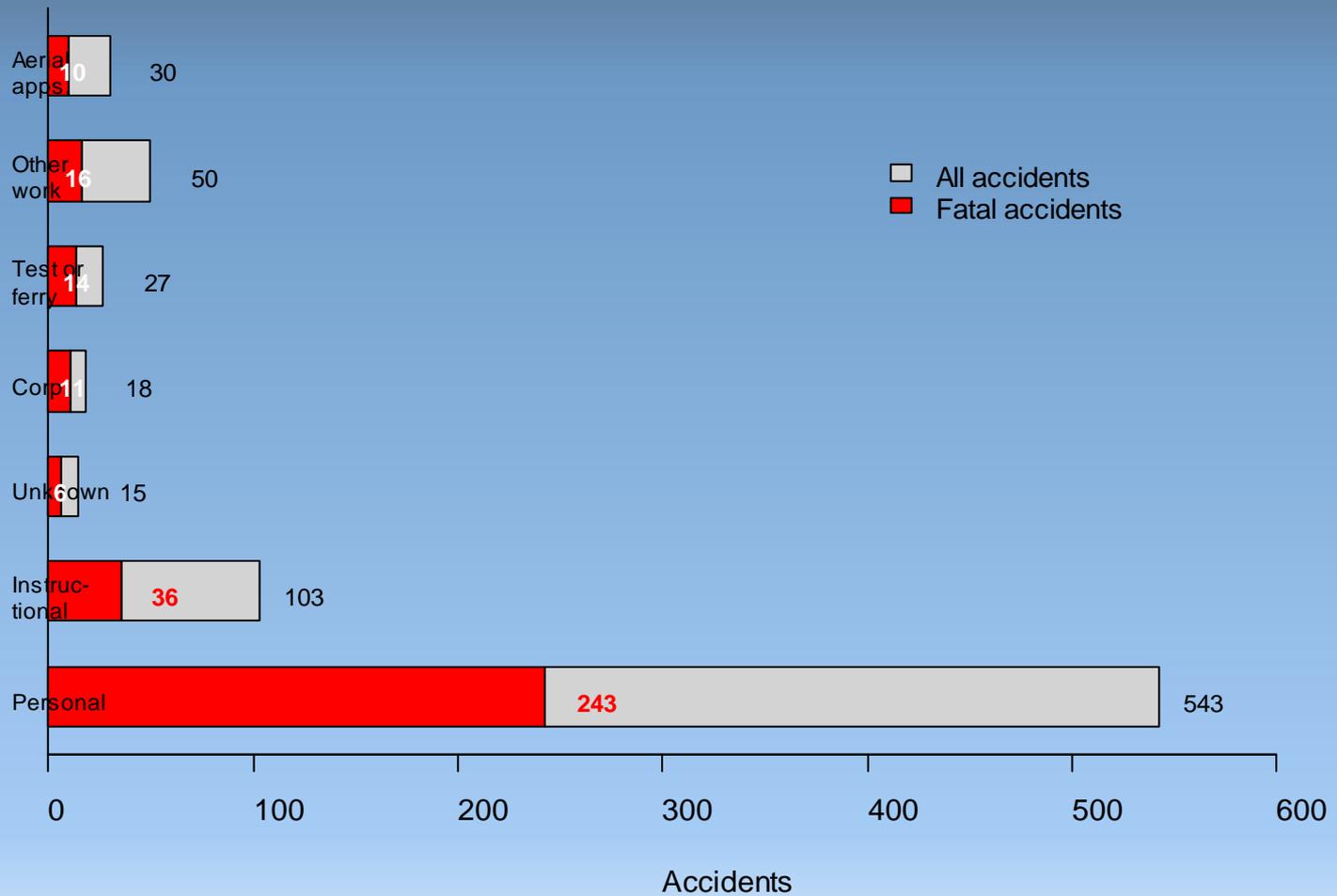


Aircraft involved in stall



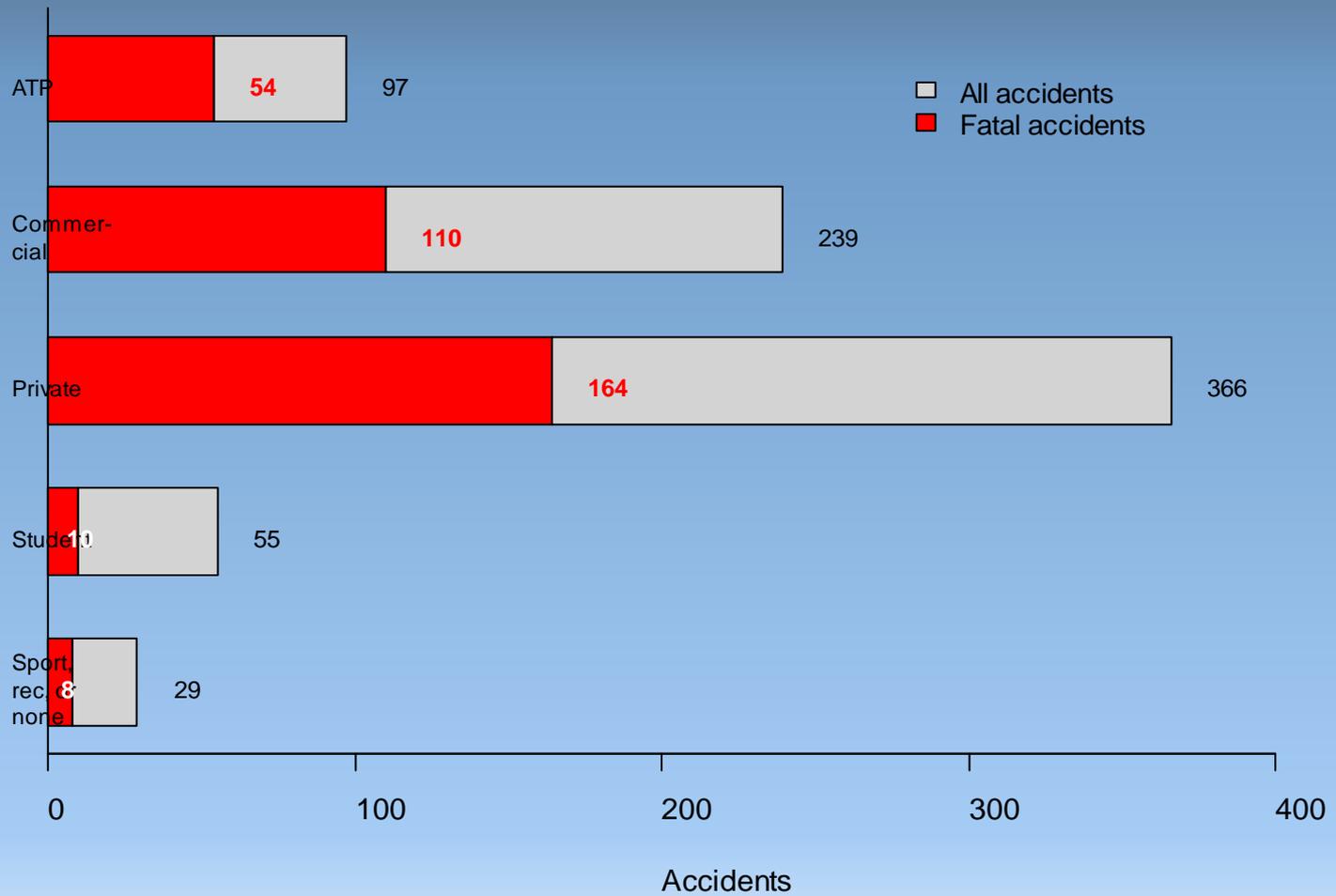


Purposes of accident flight





Accident pilots' certification





RESOURCES: www.airsafetyinstitute.org

On-line courses:

Essential Aerodynamics: Stalls, Spins, and Safety

Do the Right Thing: Decision Making for Pilots

ASI Flight Risk Evaluator

Real Pilot Story:

The Impossible Turn



RESOURCES (continued):

Safety Advisors:

Maneuvering Flight: Hazardous to Your Health?

Emergency Procedures

Accident Case Studies

Communication Breakdown

Everyone's Problem

Delayed Reaction