AOPA Expo 2008

Seminar Notes

San Jose, CA

Surviving After a Forced Landing

Some Statistics:

- 35% survived the initial forced landing
    - 21 were injured, 4 survived the first 24 hours
    - 14 were uninjured, 7 survived after 72 hours

Questions to ask:

- How seriously do I take this?
- Am I prepared for the stresses of survival?

Post-Crash Survival

1. Psychology of survival (i.e. the will to survive)
    - Post-crash survival is 90% mental
    - *Must have knowledge of the search-and-rescue system*
    - In order of survival value:
        1. Oxygen
        2. Shelter
        3. Rest
        4. Water
        5. Food
    - STOP mnemonic:
        - **S**it
        - **T**hink
        - **O**bserve
        - **P**lan

2. Search and Rescue
    - **File a flight plan!** (it's cheap and it works)
    - (121.5Mhz specific) If a VFR flight plan was filed and you are overdue, it will be *2.5 hours* into your survival situation before the actual physical search begins (assuming the distress call was not received).
    - **Make occasional position reports [to FSS]**. This is especially useful on long flights
    - Plan to spend at least a night, post-crash
    - SARSAT takes 2 orbits (3hr 20min) to pinpoint a [121.5Mhz] ELT signal within 11nm.
        - But 406Mhz ELTs are near-instantaneous
    - In general, you will be found 2 days sooner with a functional ELT

- The Air Force Rescue Coordination Center estimates that as many as 12% of ELTs do not activate when they are supposed to
- Leaving your cell-phone on (VFR, and see FAR 91.21(b-5)) can help search-and-rescue teams

3. Surviving Extreme Environments
   - Sweating (See "Danger of Dehydration" handout)
   - **Don't get in the plane thirsty**
   - Hot-land environments
     - Stay out of the sun
     - Stay off the desert floor (at least 1 foot)
     - Don't spend energy in the daylight
     - GET WATER (see handout on two water-collection methods)
     - Note: Hypothermia *can still occur* when the air temperature is above freezing
   - Cold-land environments
     - Dress for the external environment (or at least bring appropriate clothing along)
     - 50% of all body heat is lost through the head and neck
     - Stay covered
     - Frost-bite is irreversible
     - Snow-blindness: wear sunglasses
     - Don't eat snow! Melt it first, then drink it
       i. Otherwise, it can lead to hypothermia
     - Clothing
       i. Wet clothing in the wind will draw off body heat **20 times faster** than wind alone
       ii. A wool sweater has the greatest insulative capacity
       iii. A wool sweater is the best material for retaining its insulative capacity when wet
   - Your clothing will be your most immediate source of shelter

4. First Aid / Self Aid
   - ABC mnemonic (order of treatment):
     - **A**irway
     - **B**reathing
     - **C**irculation
   - The recommended method for opening a person's airway if it is obstructed is by tilting the head back, or the jaw thrust
   - **Give CPR only if you have been trained to**

- **Hemorrhage control: Treat quickly and aggressively!**
- Types of bleeding
    - Arterial
    - Venous
- **Don't take off saturated bandages!** It disrupts the clotting
- Pressure points for bleeding: There are only 12 of them, so learn them
- ***Only apply a tourniquet as a last resort***
    - **Mark the time it was applied:** you have 2 hours before the extremity below will need blood

Single-Pilot IFR

- Single-pilot IFR accounts for more accidents than 2-pilot crews
- 45% of pilots in weather-related accidents were instrument rated

- The main factor: workload (multi-tasking)
    - But there are ways to do it safely: it's all about priority

- Regulations & Procedures: they take the decision process out

- **SRM** (CRM for single-pilot operations)

1. Preparation
    - Set personal minimums
    - Pre-flight (aircraft, weather, route, etc)
    - Known the risks (both present & future)
    - You aren't really alone (ATC, passengers, etc)

2. Resource Management
    - Yourself
    - "Virtual Copilots"
        a. Passengers
        b. Equipment
            i. GPS/FMS
            ii. Autopilot <- The most important piece of equipment
        c. Charts, plotters, etc
        d. ATC
    - You must know how to use the technology (and their limitations)
    - **In a 2-pilot crew, a re-route is a 2-person job**

3. Decision Making
    - Decision making is a continual process
        a. Anticipate
        b. Recognize
        c. Act
        d. Evaluate
    - Pay attention and be aware of any changes
    - **Memorize emergency checklists**
        - Talk the procedures out loud to yourself while performing them
    - Situational Awareness: Knowing…

- Where you are
- Where you are going
- How you will get there
- **And always have an out**
    i. Best to plan this *on the ground*

4. <u>Communication</u>
    - ATC, FSS, Passengers
    - Other pilots

    - Working with ATC
        a. Listen before speaking
        b. Reference position to a local navaid/fix
        c. Make deviation requests early
            i. (i.e. If you hear other aircraft ahead of you on the same route are going missed, better to deviate now than wait)
        d. *Know when to say "Stand By"*
        e. **Ask for an initial heading** if you need time to program in a route change

- <u>Passengers</u>
    - Maintain a sterile cockpit
    - They can help with see-and-avoid
    - Keep them under control

- **Last component of SRM: Yourself!!**
    - Know your current proficiency
    - Know your equipment
    - Know your health
    - Stay organized -> Build a "nest" in the cockpit

- If you fly IFR infrequently, get a 6-month IPC

Stall/Spin Awareness:
What you don't know CAN hurt you

- Stalls and Spins were first recorded by the Wright brothers in 1912
  - These have been with aviation since the beginning

- FAA-RD-77-26, 09/76: "General Aviation Pilot Stall Awareness Study"

- First rule: fly the plane

- Study: Extra stall training made no difference in accidental stalls
  - Most planes have their stall warning on only one wing and no AOA indicator
    - The other wing could stall first
  - **BUT**, additional spin training DID decrease accidental spins

- **True cause of spins: Excess yaw @ stall = spin**
  - (The saying "no stall, no spin" is simplistic)
  - Causes of excess yaw:
    - Adverse yaw (ailerons)
    - Torque, p-factor, slipstream (engine)
    - Improper footwork (rudder)

- When flying VFR, *trust your senses*
  - *Stop staring at the ball*

- Turn coordinator ball:
  - It has a bank limit (and a small amount of lag)
  - Not the end-all of yaw control, and may not show instantaneous coordination
  - Use the ball for fine-tuning

- Swept-wing planforms:
  - Stalls at the wingtip first, aggressive stall with pitch up, lateral control immediately lost
  - *Exccessive yaw can turn a basic rectangle planform wing* (good stall characteristics) *into acting like a swept-wing*

- Spin Recovery (discussed in detail in next topic)
  - **P**ower
  - **A**ilerons
  - **R**udder
  - **E**levator

The PARE Procedure

- 2 necessary ingredients for a spin: (1) yaw, (2) stall
  - Sources of yaw: rudder use, adverse yaw, engine effects

- Terms
  - A procedure is "what" needs to be done
  - A technique is "how" it will be done
  - "Elevator Through Neutral" refers to moving the elevator toward which ever way is neutral (direction agnostic)

- In spin recovery, the elevator is the last input to move
- Elevator magnitude of movement depends on whatever it takes to stop whatever is still happening

- Sequential inputs tend to be *more effective* than simultaneous inputs
- Eliminate power and aileron inputs early
- Rudder followed by elevator is a critical sequence of events

- ***You can't do stall recovery while still in a spin!***

- Spin Recovery
  1. **P**ower <- Off (i.e. to idle)
  2. **A**ilerons <- Neutral, Flaps up (if they were down)
  3. **R**udder <- FULL opposite to yaw direction, BE ABRUPT!
     - Put the other foot on the floor to ensure that you are using *full* opposite rudder
  4. **E**levator <- Through neutral (Not before rudder application, but don't wait until rotation is finished)
  5. Hold the above inputs until rotation stops!
     a. Spin recovery may time TIME and ALTITUDE

- Once the spin is done
  1. Rudder <- Neutral
  2. Elevator <- Easy pull, back to straight-and-level
- Turn Coordinator ball is useless in a spin
  - The needle/airplane will be wing-low in the direction of the spin (upright spins only)

- The "Hands Off" (Beggs method)

- Not always as good as the NASA "PARE" method
- It might also not work at all

- <u>Spin Physiology</u>
  1. Channelization of sensory inputs (similar to "target fixation")
  2. Inability to judge the passage of time
  3. Limited control of muscular inputs (e.g. freezing at the controls)
  4. VOD (vestibulo-ocular disorganization) – i.e. disorientation

- Most aircraft have a one-turn spin margin of error
  - Most spin-approved aircraft will outlast the pilot's physiological limit
    - Spin will appear to speed up at the physiological limit, when really it is stabilizing: this is VOD

- Once recovered from a prolonged spin, post-rotatory nystagmus or vestibular sensations can fool the pilot into re-entering a spin

- *All types of spins have the same recovery method* (PARE)

Single-Pilot Flying Strategies

- If you're working hard at flying, you're probably doing it wrong

- Cockpit wisdom comes from understanding our human nature
  - Understanding & recognizing external pressures
  - What compels us to act

- Aircraft today are easier to fly, but not to operate

- We don't fly "all-weather" aircraft
- We don't have airline-like training
  - Or any of the other resources they have (dispatchers, copilot, etc)

- **We are not a scheduled airline!**

- Biggest single-pilot concerns
  - Workload <- Talking to yourself can help
  - **The 2 most important things in aviation…are the next 2 things**
    - Be proactive, not reactive

- Verbal Checklists:
  1. Horizontal Movement
     a. Where am I?
     b. Where am I going?
     c. How do I get there?
  2. Vertical Movement
     a. How low?
     b. How long?
     c. Which way?
  3. Nav Equipment
     a. See it
     b. Say it
     c. Check it

- "Stand By" <- The two most important words to learn

- Getting ATIS: Ask the controller if you can go off frequency for 3 minutes to get the ATIS. If being vectored, you can ask the controller for the ATIS

- Routing changes: See “Single Pilot IFR”; ask for an initial heading

- Asking ATC when they are busy:
  - Ask questions that only require a yes or no answer
- Tell ATC what you need:
  - You can ask for anything you need/want
- Ask ATC/FSS to explain/define
  - (e.g. weather VOR references, etc)

- **Use your “time machine”**
  - If you need time [to think], slow down (but notify ATC)

- NASA study -> For single-pilot flying, a single-axis (wing-leveler) autopilot is the best. Multi-axis autopilots tend to remove the pilot from being mentally engaged

Managing Your Engine for Peak Performance

- Avoid engine starts (when possible)
- Lean aggressively
- Have as few thermal cycles as possible
- High MP/low RPM

- Don't keep pre-heaters plugged in all the time if the temperature swings above/below freezing: this can lead to condensation
- Don't pull the prop through if you're not going flying
- Don't run the engine for 20 minutes if you aren't going flying

Lycoming service instruction

- Don't lean above 75%
  - <=75% power: lean to 50* ROP
  - <=65% power: lean to peak regardless of altitude

- Note max CHT
  - Continental: 400*F, Stay below 460*F redline
  - Lycoming: 425*F, Stay below 500*F redline
  - CHTs between 350*F and 380*F in cruise
  - Oil Temp of 180*F in cruise

- Lean for all ground taxi operations
  - No permanent damage can be done on the ground by over-leaning (though the engine may stop if leaned too much)

- Engine monitors are great diagnostic tools, and pay for themselves

- 125*F ROP = Best power
  - Good for high-and-hot takeoff operations
- 45*F LOP = Best economy

- Minimize heat up & cool down cycles
- **No part-throttle takeoffs**
  - We should ignore engine-life concerns during takeoff
  - Make the climb from "V_1" to 1000' AGL as quickly as possible

- Reducing power (variable-pitch prop): Reduce 2" MP in 2 minutes
  - Equates to ~50*F CHT/minute

- Use cowl flaps to control CHTs

- Any power setting in the POH is an approved setting
- Consider the accuracy of the tach and MP gauge
- Engine actually likes over-square MP/RPM
    - Propeller operates better at low RPMs
    - Of course, any turbo-charged engine will be operated over-square
    - Many POHs actually list over-square settings
    - HP loss to friction is lower at lower RPMs

- Fly frequently
- See hand-out for 6 tools for determining engine health