

Hazards and Safety

- Both general and UAS-specific hazards
- Emergency authority and procedures
- Aeronautical Decision Making (ADM)

Hazards

- Unmanned balloons
 - Sometimes charted if frequently in use
- P-static (precipitation static)
- Thermal plumes
 - Can cause loss of control and altitude deviation
 - Plume direction affected by wind
 - Not related to “thermals” discussed in weather
- Buildings and wires
 - “Flying in the wire environment” (SAFO 10015)
 - https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo/all_safos/media/2010/safo10015.pdf

Hazards (continued)

- Density Altitude
 - Air pressure corrected for temperature
 - High temperature → high altitude → low pressure
 - Affects aircraft performance
 - Rule of thumb: $DA = PA + 120 * (OAT - ISA)$
- Wind
 - Affects stability and controllability
 - More power to stay on station, lower lift capability
- Emergency inspection of other aircraft

Hazards: Icing

- Visible moisture and surface is 0°C or lower
 - Worst between -15°C and 0°C
 - Can be -40°C to +5°C or even colder/warmer
- Multiple threats:
 - Changes airfoil shape
 - Increases aircraft weight
 - Changes stability
- Multiple kinds: rime, clear, mixed

Hazards: Thunderstorms

- Threats extend for 20 miles in all directions
- Lifecycle: cumulus, mature, dissipating
- Elements:
 - Sufficient water vapor
 - Unstable lapse rate
 - Lifting action
- Air mass vs. steady-state storms
- Weather RADAR only shows rain, not storm itself
- Gust fronts, hail, lightning, air pressure changes

Emergencies

- Any time a safe outcome is in doubt
- Remote PIC has authority
- Should plan for expected problems
 - Abort point for take-off
 - Return point for failure in flight
 - Roles for participants
- Follow manufacturer's procedures

Accident Reporting

- Report accident to FAA within 10 days if:
 - serious injury to any person or any loss of consciousness
 - damage to property (not UAS) exceeding \$500
- NTSB (49 CFR 830.5) “immediate” notification
 - Required for all aircraft; control problems, flyaway
 - In-flight fire, personnel problems, collision, propeller
 - “Substantial damage” also if over 300 pounds or over \$25,000
- Other accident issues not on test:
 - Insurance, legal liability

Incident Reporting

- Report to ATC or Flight Service (FSS)
- Near mid-air (500 feet) collision
- Unauthorized laser illumination
 - <http://www.faa.gov/about/initiatives/lasers/>
- Bird and other wildlife strikes and encounters
 - <http://wildlife-mitigation.tc.faa.gov>

Emergencies: Fire

- Lithium batteries are light but high fire risk
- Must inspect batteries before flight
- Fires spread rapidly and cause loss of control
 - Land at first indication

Emergencies: Radio

- Loss-of-link is not an emergency
 - fly-away starts as loss, and is an emergency
- Plan alternate landing sites and ATC
- 2.4GHz and 5GHz bands are crowded
 - Especially near buildings
- GPS faults can happen; check in pre-flight
 - <http://sapt.faa.gov/default.php>

Aeromedical Factors

- Important safety area
 - On test, though not UAS specific
- Chapter 17 of Pilot's Handbook of Aeronautical Knowledge (30pp)

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/19_phak_ch17.pdf

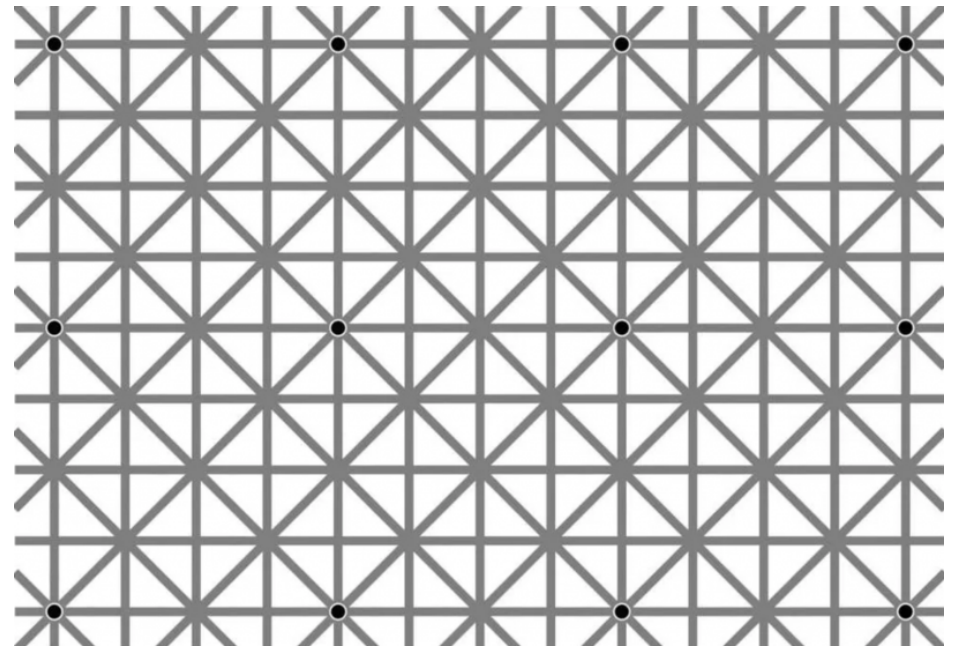
- Just ignore medical certificate parts
- Be aware of dehydration and heat stroke
 - Headache, nausea, confusion

Medical: Hypoxia

- Hypoxic Hypoxia (lack of air, drowning)
 - Same proportion of O₂, but thinner air at altitude
- Hypemic Hypoxia (CO, blood loss)
- Stagnant Hypoxia (G-LOC)
- Histotoxic Hypoxia (drugs, poisons)
 - Smoking makes other hypoxia types worse

Medical: Illusions

- Cones at center
 - Acuity, color
- Rods distributed
 - Sensitive, night vision
- Blind spot
- Empty-field myopia
- Fixation



Aeronautical Decision Making

- AC 60-22 is an introduction
- Systematic approach
- Based on real accidents and incidents
 - United 175 (DC-8 JFK to PDX) was a starting point
- Many tools and techniques
- Important FAA focus area

ADM: Common Pitfalls

- Peer pressure
 - Job demands and expectations
- Getting behind aircraft
 - Need to slow things down especially in emergency
- Loss of situational awareness
 - Focus on one item and ignoring others
- Neglect of planning
 - Complacency builds with experience, use checklists

ADM: Stress

- Stress is cumulative, normal part of life
- Affected by sleep, but sleep is no cure
- Chronic vs acute
- Key concepts:
 - Workload reduction
 - Slow down
 - Maintain proficiency to build confidence

ADM: DECIDE Model

- Model for making decisions
 - **D**etect a change
 - **E**stimate the need to react
 - **C**hoose a desired outcome
 - **I**dentify actions that can be taken
 - **D**o the action
 - **E**valuate the results
- Continuous loop

ADM: CRM

- Crew Resource Management
- Use participants and ATC to help
- Useful airline technique:
 - Position or title
 - State concern
 - Recommend course of action
 - Ask for agreement
- Root issue in many accidents

ADM: Hazardous Attitudes

- Attitude, memory device, antidote
 - Anti-authority: "Don't tell me"
Follow the rules; they are usually right.
 - Impulsivity: "Do something now"
Not so fast. Think first.
 - Invulnerability: "It won't happen to me"
It could happen to me.
 - Macho: "I can do it"
Taking chances is foolish.
 - Resignation: "What's the use?"
I'm not helpless. I can make a difference.

ADM: Risk Assessment

- Identify potential risks
- Determine severity and likelihood
 - Combination determines seriousness of issue
- Choose mitigation, avoidance, or acceptance
 - Extra observers, bring along experienced adviser, delay until more favorable conditions
- Use rules of thumb to break accident chain
 - E.g: After three errors, terminate operation
- Consider maintenance, new equipment, and new employees as sources of extra risk