# NTSB Study Library

*Curated NTSB accident categories. Each entry has a brief description, the lesson the FAA / NTSB has codified, the related ACS task, and a search-ready query into the live NTSB CAROL database.*

Read these *not* to assign blame, but to understand the chain of decisions that led to the outcome. Aviation safety is built on the lessons in these reports.

# Helicopter (Rotorcraft)

Most common scenario: steep approach with a tailwind, high gross weight or high density altitude, descent rate exceeds the recovery margin once airspeed bleeds below ETL. Recoveries with extra collective worsen the condition.

**Lesson:** Recognize wind direction on every approach. If descent rate builds with airspeed below ETL and additional collective doesn't help — it's VRS, not normal sink. Recover with forward (or lateral, Vuichard) cyclic and a small collective reduction. Don't add collective.

**ACS task:** Private & Commercial Heli ACS Area VIII (Emergency Operations)
**NTSB CAROL query:** *settling with power helicopter*

Pivot point on the surface (skid stuck, slope, snow, ice, rough ground) past the critical roll angle (~8-10°). Cyclic alone cannot recover after the critical angle.

**Lesson:** Smooth, coordinated collective on lift-off and touchdown. If cyclic cannot keep the disc level, reduce collective immediately. Brief dynamic rollover before every slope, snow, or rough-terrain operation.

**ACS task:** Heli ACS Area V (Slope & Confined Area Operations)
**NTSB CAROL query:** *dynamic rollover helicopter*

Uncommanded yaw at low airspeed and high power. Common in OGE hover, photo / sling-load operations, and out-of-wind hover taxi. Pilots often add collective trying to hold position, which worsens the yaw.

**Lesson:** Know the four hazardous wind regions (AC 90-95). If uncommanded yaw begins, full opposite pedal + forward cyclic to gain airspeed + reduce collective if obstacles permit.

**ACS task:** Heli ACS Area VIII.D (Anti-Torque Failures)
**NTSB CAROL query:** *loss of tail rotor effectiveness helicopter*

Low-G push-over or abrupt cyclic in a teetering rotor system unloads the rotor; a roll input then translates into the rotor flapping past its limits and striking the mast. Typically catastrophic.

**Lesson:** Smooth aft cyclic to load the rotor before any lateral correction. Avoid abrupt pushovers. SFAR 73 awareness training covers this — treat it as gospel.

**ACS task:** Heli ACS Area V/VIII; SFAR 73 awareness training
**NTSB CAROL query:** *Robinson mast bumping low G*

Carb ice forms in conditions of high humidity even at OAT 20-70°F, causing partial then total power loss. Common in cruise descent or low-power conditions.

**Lesson:** Monitor the carb-temp gauge; apply carb heat per RFM. Robinson Safety Notices SN-25 / SN-37 are non-negotiable reading.

**ACS task:** Heli ACS Area I.G (Operations of Systems)
**NTSB CAROL query:** *Robinson R22 R44 carburetor ice*

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VFR helicopter pilot encounters IMC unexpectedly — fog, rain, low ceilings — and tries to scud-run or turn back at low altitude. Loss of control or CFIT follows.

**Lesson:** Immediate level wings on AI, climb to MEA/MSA, declare emergency, request vectors to VMC. Train the procedure before you need it. Pre-flight personal minimums must include 'I will not scud-run.'

**ACS task:** Heli ACS Area VII; AIM 7-5-9
**NTSB CAROL query:** *helicopter inadvertent IMC IIMC*

Helicopter strikes power lines, antennas, or cables — most common during low-altitude operations, agricultural work, or confined-area ops. Wires are often invisible until impact.

**Lesson:** Look for poles and antennas, then assume wires connect them. Plan approach paths to avoid known wire areas. Brief escape routes at low altitude.

**ACS task:** Heli ACS Area V (Confined Area / Pinnacle)
**NTSB CAROL query:** *helicopter wire strike powerline*

Pilot misjudges flare timing, allows rotor RPM decay, or runs out of energy before touchdown. Common during practice autorotations and training.

**Lesson:** Maintain Vauto and rotor RPM in the green. Initiate flare early enough to arrest descent. Cushion with collective at the right moment. Practice with a current CFI.

**ACS task:** Heli ACS Area VIII.E/F (Autorotation)
**NTSB CAROL query:** *helicopter autorotation accident*

Engine failure occurs in the 'avoid' region of the height-velocity diagram — too low to autorotate fully, too slow to fly out. Survivability depends on terrain and pilot reaction.

**Lesson:** Brief the H-V diagram for every takeoff profile. Use a Max Performance or Normal Takeoff to minimize time in the avoid region. Always plan a forced-landing area within 60 seconds of every flight phase.

**ACS task:** Heli ACS Area VIII.B; RFM Height-Velocity diagram
**NTSB CAROL query:** *helicopter engine failure takeoff*

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# Airplane (ASEL)

Pilot overshoots final, uses bottom rudder + opposite aileron to 'stretch' the turn back to centerline. The airplane enters a cross-controlled stall — usually too low to recover. Almost always fatal.

**Lesson:** If you overshoot final, GO AROUND. Never use rudder to fix overshoot. Maintain coordinated flight in the pattern. Train the recognition of the cross-controlled setup.

**ACS task:** Private & Commercial Airplane ACS Area VII (Slow Flight, Stalls); AC 61-67
**NTSB CAROL query:** *stall spin base to final airplane*

Airworthy aircraft flown into terrain or water — typically in IMC or at night, often with the pilot believing they had adequate clearance. Mountain accidents and night descents are classic.

**Lesson:** Know the terrain. Use MEA / MOCA / OROCA. Cross-check radar altimeter or sectional terrain data on every leg in low visibility. Don't descend below the published procedure altitude until the procedure says you can.

**ACS task:** Airplane ACS Area I (Preflight Preparation, Risk Management)
**NTSB CAROL query:** *controlled flight into terrain CFIT airplane*

Pilot runs out of fuel — sometimes from miscalculation, sometimes from failing to switch tanks, sometimes from operating beyond reserves. Surprisingly common in single-engine accidents.

**Lesson:** Plan with reserves above the regulatory minimum. Verify fuel quantity visually before takeoff. Use a timer and a fuel-burn cross-check at every fuel-management point. Land if fuel is uncertain.

**ACS task:** Airplane ACS Area I.C (Fuel Planning); §91.151, §91.167
**NTSB CAROL query:** *fuel exhaustion airplane*

VFR-only pilot continues into deteriorating weather and enters IMC. Spatial disorientation follows quickly — often within 2-3 minutes of entering cloud.

**Lesson:** Pre-flight personal minimums must include hard ceiling and visibility floors. If conditions deteriorate, turn around before entering cloud. If IIMC: trust the instruments, level wings on AI, climb to MEA, declare, request vectors.

**ACS task:** Airplane ACS Area I.B (Weather); AIM 7-5-9
**NTSB CAROL query:** *VFR into IMC airplane*

The leading cause of fatal GA accidents. Includes stall-spin, low-altitude maneuvering, distraction-induced upset, autopilot mismanagement, and wake-turbulence loss of control.

**Lesson:** Recognize stall warnings early; recover by reducing AOA. Train coordination. Maintain situational awareness during turns and maneuvers. Consider Upset Prevention & Recovery Training (UPRT) as part of your annual proficiency.

**ACS task:** Airplane ACS Area VII / VIII; Upset Prevention & Recovery (UPRT)
**NTSB CAROL query:** *loss of control in flight airplane*

Engine fails shortly after takeoff. Pilot tries to turn back to the runway from too low an altitude. Bank angle increases, airspeed decreases, stall-spin into the ground.

**Lesson:** Brief 'if engine fails before [X altitude] I land straight ahead within 30°.' The 'impossible turn' altitude varies by airplane — typically 800-1,000 ft AGL minimum, and only if practiced. Below that altitude, land straight ahead.

**ACS task:** Airplane ACS Area IX.B (Emergency Approach & Landing)
**NTSB CAROL query:** *engine failure after takeoff turn back airplane*

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Airplane accumulates structural ice — leading edge, tailplane, or pitot. Performance loss and / or tailplane stall on flap deployment. Loss of control on approach is common.

**Lesson:** Know the airplane's ice protection (or lack thereof). Recognize early signs. Plan an icing escape: change altitude, reverse course, or divert. Pitot heat ON in clouds. Read AIM 7-1-19 and the AFM icing chapter every winter.

**ACS task:** Airplane ACS Area I.B; AIM 7-1-19
**NTSB CAROL query:** *airframe icing accident airplane*

Airplane enters an active runway without clearance, or pilot loses positional awareness during taxi. Most occur at unfamiliar airports, at night, or with complex taxi instructions.

**Lesson:** Brief the taxi route before pushback. Hold short markings are non-negotiable. Read back hold-short instructions verbatim. Stop and ask if uncertain. AC 91-73 has the full taxi-discipline doctrine.

**ACS task:** Airplane ACS Area III; AC 91-73
**NTSB CAROL query:** *runway incursion airplane*

Hot, high, heavy takeoff. Airplane fails to climb adequately, hits trees / terrain at the departure end. Common in mountain departures and summer high-altitude airports.

**Lesson:** Compute the actual density altitude and the actual takeoff performance for the day. Apply margin (book × 1.5 for grass / soft / unfamiliar). Reduce weight if performance is marginal. Know the airplane's service ceiling and rate-of-climb at the day's DA.

**ACS task:** Airplane ACS Area I.F (Performance & Limitations)
**NTSB CAROL query:** *density altitude takeoff accident airplane*

Smaller airplane encounters wake from a heavier aircraft on takeoff or landing — typically rolls inverted, often at altitudes too low for recovery.

**Lesson:** Stay above and upwind of the heavier aircraft's flight path. On takeoff, rotate before the heavy's rotation point. On landing, touch down beyond the heavy's touchdown point. ATC standard 2-minute hold is the floor, not the goal.

**ACS task:** Airplane ACS Area III; AIM 7-3
**NTSB CAROL query:** *wake turbulence accident airplane*

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