Emergency Maneuver Training

Controlling Your Airplane During A Crisis

Rich Stowell

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by Rich Stowell
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Dedication

To my best friend, Jan Evans.

About The Author

Rich Stowell received his private pilot's certificate in January, 1984, from Burnside-Ott Aviation Training Center. In September, 1987, Stowell left his engineering career behind to become Chief Aerobatic Pilot at CP Aviation in Santa Paula, California. He became a Certified Flight Instructor nine months later.

While at CP Aviation, Stowell turned an existing emergency maneuvers course into the renowned EMT® — Emergency Maneuver Training — Program. The Program and Stowell's teaching techniques have been featured in several aviation magazines, including *Flying*, *Private Pilot*, *Sport Pilot*, *Hot Kits & Homebuilts*, and *AOPA Pilot*.

Stowell has given over 8,000 hours of EMT®, spin, and basic aerobatic instruction. He has been a frequent lecturer at the annual EAA conventions at Oshkosh, Wisconsin, and Lakeland, Florida, as well as a contributing editor for *Flight Training* magazine. Stowell wrote, associate produced, and hosted several critically acclaimed educational videos on emergency maneuver training, stall/spin awareness, and basic aerobatics. His first book, *PARE® — The Emergency Spin Recovery Procedure*, based on the PARE® acronym he developed as part of the EMT® Program, was published in 1991.

Stowell is a member of the Society of Aviation and Flight Educators, the International Aerobatic Club, the Aerobatic Club of America, the Experimental Aircraft Association, and the Aircraft Owners and Pilots Association. He is a FAASTeam Lead Representative, and is active as a speaker at Aviation Safety Programs across the country. He also holds a Bachelor's degree in Mechanical Engineering from Rensselaer Polytechnic Institute in Troy, New York.

For his contributions to aviation safety and education, Stowell received the FAA/Industry National Flight Instructor of the Year Award in 2006 and the IAC President's Award in 1994.

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Acknowledgments

Wow! Little did I know that it would take seven years to complete this project. But then, that's how long it took for my own experience to evolve to the point where I could present these topics in a reasonably comprehensive, easily readable form. Of course, none of this would have been possible without the assistance of a host of other people. So, let me gratefully acknowledge...

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Portions of this book have appeared in articles written by the author for *Plane & Pilot* and *Flight Training* magazines.

Disclaimer

This book is intended to be a teaching tool for emergency maneuver and other unusual attitude training programs. The information presented herein is as accurate, complete, and authoritative as possible. However, there may be errors and omissions, both typographical and in content.

This book should be used as a general guide only and not as the ultimate source of aeronautical principles or procedures. It is designed to complement and supplement other aviation texts and formal flight instruction. For additional reference materials and recommended reading, refer to the Bibliography.

Stalls, spins, inverted flight, and other unusual attitudes, whether intentional or unintentional, may be life threatening. The information presented herein is not a substitute for actual flight training or for proficiency in the maneuvers and techniques described. The author and publisher strongly recommend that you receive hands-on flight training only from qualified flight instructors experienced in the procedures outlined herein, using only approved, well maintained, and properly loaded airplanes with appropriate safety equipment—including parachutes—before attempting any of the maneuvers described in this text.

The author and the publisher shall not be liable or responsible to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this book. This text is not a substitute for common sense or the exercise of good judgment.

As stated in the Federal Aviation Regulations, Part 91, Section 91.3, Paragraph (a):

> *The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.*

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Emergency Maneuver Training

"it is possible to fly without motors, but not without knowledge and skill."
—Wilbur Wright

This profound thought was conveyed in a letter to the pioneering glider designer, Octave Chanute, years before the Wright Brothers' historic first powered flight. It reveals the essence of becoming a proficient pilot. In a life that holds few guarantees, pilots are guaranteed one inescapable truth: every takeoff will be followed by a landing. Determining exactly where, when, what condition, and in what attitude the airplane will return to the Earth is the most challenging part of learning to fly. Compared to now, early aviators were handicapped with unreliable powerplants. To compensate for deficiencies inherent in their equipment, they had to master the art of flying; it simply was a matter of survival. Fortunately, they didn't have the additional burden of dealing with a complex web of structured airspace, massive regulations, and sophisticated equipment.

Even though greater system reliability has reduced the likelihood of an unscheduled landing, today's pilots must be adept at traversing an intricate airspace system. They must be able to communicate effectively on the radio. They must be familiar with an array of instruments, bells, whistles, and other gadgets bristling from the instrument panel, as well as a variety of other requirements. The broad scope of experience needed for modern aviation, however, often detracts from time spent perfecting the sole operation that's a matter of life or death in the air: **FLYING THE AIRPLANE**!

General aviation has undoubtedly benefited from technological advances over the years, but the fundamental relationship between pilot and airplane remains unchanged. We can modify Mr. Wright's statement, in fact, to fit today's complex flight environment without diminishing the significance of its message:

"It's possible to fly without motors, radios, VOR, GPS, sectional charts, control towers, and Class E airspace, but not without knowledge and skill."

Nowhere are knowledge and skill more important than during an in-flight crisis; sadly, nowhere are weaknesses in these areas more evident, either. The responsibility for surviving an in-flight emergency rests squarely on the pilot's shoulders. The probability of successfully recognizing and dealing with in-flight problems ultimately boils down to one, and only one action: flying the airplane. More often than not, those who habitually do the right things enjoy long and happy flying careers; those who do the wrong things, don't. An all-too-common accident report bears this out:

> *The aircraft lost power on takeoff a few hundred feet above the ground. Witnesses said the airplane entered a steep turn at low airspeed when it suddenly descended out of control [or rolled inverted and crashed, or entered a spin].*

All that's missing is a date, time, place, type of aircraft, and number of occupants on board. What's not addressed, though, are questions like, why do such similar accidents continue to occur? how come these accidents don't discriminate between experienced and novice pilots? and what's going on in the cockpit?

A loss of power does not, in and of itself, cause an airplane to descend out of control. It's the pilot's reaction to an engine failure, or any other emergency for that matter, that determines the ensuing course of events. Pilot error, which is cited as a primary factor in most accidents, results from three elements influencing the pilot: distraction, faulty perceptions, and inappropriate control inputs.

What basic knowledge and skill components are missing in flight training that influence a pilot's reactions in favor of an accident? Simply, a lot of pilots learn to fly within a bubble that is much smaller than the airplane's operating envelope. Gray areas left in primary training often multiply as pilots are exposed to a wider assortment of in-flight situations. This can lead to self-doubt about one's flying abilities, which fosters confusion, an increasing lack of confidence, and apprehension at the controls. To drive home the importance of sharp flying skills, let's simulate the classic stall/spin accident during a base-to-final turn.

Assume we're flying a left-hand pattern, close to the ground, in a strong wind, at an unfamiliar airport (multiple distractions). As we begin our turn from base to final, the airplane overshoots the runway centerline. Our normal range of experience and comfort level preclude us from increasing the angle

of bank any further to correct back to the centerline (faulty perception), particularly close to the ground (distraction). Instead, we elect to skid our way onto final approach using the rudder (inappropriate input).

We're trying to turn with the rudder (inappropriate input) only because we're close to the ground in a critical configuration (distractions). The rudder doesn't turn the airplane; it YAWS it. Its primary function is to cancel yaw, keeping the airplane in coordinated flight and safeguarding against spinning. But now here we are intentionally misapplying the rudder. We're actually teasing the airplane with precisely what it needs to spin (inappropriate input).

The rudder input slices the nose downward, through the horizon. In our straight-and-level experience, the elevator appears to hold our nose "up" (faulty perception), so we respond with back elevator pressure (inappropriate input). Unfortunately, back elevator neither holds us up, nor can it stop the yaw generated by the rudder. Back elevator pressure absolutely, positively, always pulls us closer to critical angle of attack and a stall. Even though it's not our intention to stall with excessive rudder applied a few hundred feet above the ground, we are nevertheless configuring the airplane for this eventuality.

Compounding matters, the rudder input causes the outside wing to travel faster than the inside wing; hence, it experiences more Lift, rolling us farther into the turn. We didn't want to increase our bank in the first place, so we respond now by applying opposite aileron. Given our proximity to critical angle of attack, this input is inappropriate. In fact, deflecting the ailerons at this stage could initiate a stall earlier than usual and could aggravate stall characteristics.

We've forgotten about the runway, the turn, and the strong wind by now. Our attention turns to the developing unusual attitude and the odd movements seen over the nose (new distractions). Figuring our corrective actions mustn't be strong enough (faulty perceptions), we vigorously apply more of everything (inappropriate inputs). The airplane, obeying our every command, suddenly snaps into a spin.

Pilots certainly don't intend to spin in the traffic pattern, yet those who have did so by unwittingly duplicating the inputs required to spin. The chain of events leading to the classic stall/spin accident center around miscommunication between the pilot and the airplane. Much of the confusion stems from our normal flight experience, which represents a limited snapshot of a much larger, more dynamic picture.

For instance, at what point do our normal perceptions become erroneous in a skidding turn? Twenty degrees of bank, maybe less. How much yaw does it take to excite the spin? A glance at the slip/skid ball reveals, amazingly, that it's resting JUST A HALF A BALL OUT FROM THE CENTER! Any excess yaw at the wrong time can excite Autorotation. Without acute situational awareness, a good understanding of aerodynamics, and proper stick-and-rudder skills, how can we ever know with certainty where the edge of our operating envelope really is?

Exposing pilots to the full 360 degrees of roll, yaw, and pitch possible in an airplane is not a new concept. The first formally-recognized, all-attitude training program began in the U.S. in 1917 as the Army Air Service's, "Basic Battle Acrobacy and Trick Flying" course. Inspired by aerial combat as World War I raged on, the week-long syllabus went like this: Monday, Stalls; Tuesday, Spins; Wednesday, Loops; Thursday, Chandelles; Friday, Barrel Rolls.

Unfortunately, as the title of this early unusual attitudes course demonstrates, anything beyond normal, straight and level flight was considered "aerobatics", "trick flying", or "stunting". The benefits of aerobatic training have often been overshadowed by the stunt pilot stigma perpetuated since the early days of aviation. As a result of this negative connotation—coupled with the lack of specific guidelines for the conduct of such training—many pilots are reluctant to incorporate aerobatics into their aviation education. Emergency maneuver training, on the other hand, draws on the positive aspects of aerobatics, but it tailors them specifically to the straight-and-level pilot. Packaged as a separate class of instruction, emergency maneuver training forms a natural bridge between normal and aerobatic training.

NORMAL TRAINING	EMERGENCY MANEUVER TRAINING	AEROBATIC TRAINING
• PRIMARY	• STALL/SPIN AWARENESS	• BASIC
• INSTRUMENT	• UNUSUAL ATTITUDES	• ADVANCED
• COMMERCIAL & CFI	• SAFETY COURSES	• COMPETITION
• PART 61, 141 PROGRAMS	• CONFIDENCE COURSES	• AIRSHOW
• TYPE RATINGS	• EMT® PROGRAM	• MOVIE & STUNT FLYING

Figure 1-1: Bridging the Training Gap

The emergency maneuver training philosophy addresses the gray areas left in normal flight training. Several topics fall under this umbrella of specialized instruction, including the fundamentals of flight; stall/spin awareness; recoveries from inverted attitudes; control failures, powerplant failures, and off-airport landings; and critical maneuvers such as turns, slips,

skids, and glides. In its broadest sense, emergency maneuver training attempts to improve pilot proficiency and confidence in all flight attitudes. It strives to develop pilot awareness, recognition, and avoidance of steps that can lead to an unusual attitude. Emergency maneuver training also instills the instinctive responses needed to cope with in-flight emergencies.

Seeds for a cohesive emergency maneuver training philosophy were planted in 1984 when Tony LeVier, former Lockheed Chief Test Pilot, established a non-profit organization called Safe Action in Flight Emergencies (S.A.F.E.). The primary goal of the organization was to foster spin and unusual attitude training through scholarships used to defray some of the training's cost.

Scholarship recipients, however, needed access to schools that could accommodate this specialized training. To start, LeVier turned to his longtime friend, Sammy Mason—a renowned flight instructor, author, and test pilot. Mason designed a five hour package offered by Aerobatic Safety Unlimited (ASU), in Santa Paula, California. By 1985, ASU was teaching S.A.F.E. students under the banner, "Emergency Maneuver Training Course". Soon thereafter, two other California-based aerobatic schools joined in, earning S.A.F.E. approval for similar programs.

In 1987, CP Aviation, Inc. (also in Santa Paula) took over ASU's training operation. The medley of courses once offered by ASU subsequently underwent extensive revision. The "Emergency Maneuver Training Course", for example, was considered still too much like aerobatic training—students learned Loops, Immelmanns, Hammerheads, Snap Rolls, Vertical Reversements, Split-S's, and Inverted Spins in the first five hours. The premise behind emergency maneuver training, however, called for a stronger emphasis on more non-aerobatic elements up front; thus evolved the EMT®—Emergency Maneuver Training—Program.

Armed with the EMT Program, CP Aviation stepped to the forefront of the now burgeoning emergency maneuver training movement. The rapid and widespread success of this particular program soon lead to a string of magazine articles appearing in major aviation publications. A series of critically-acclaimed videotapes produced by Precision Productions Aviation Videos ensued. The impact of the EMT Program, combined with its magazine articles, videos, and companion seminars, certainly helped to inject the emergency maneuver training philosophy into the mainstream of general aviation.

Emergency maneuver training terminology is now common language in general aviation. The annual "Directory of Aerobatic Schools" published by

the International Aerobatic Club, for example, lists many facilities offering training under the specific headings "Emergency Maneuvers" and "Emergency Maneuver Training". Other flight schools and organizations have adopted similar language and offer comparable services to their students. Even major airlines have begun to incorporate unusual attitude recoveries into their simulator training programs (disguised under such innocuous labels as "Advanced Maneuver Training" and "Selected Event Training").

Like the first all-attitude course in 1917, emergency maneuver training hones basic VFR flying skills. It highlights the impact our control inputs have on flight, emphasizing that airplanes only respond to these inputs, not to what we hope will happen, or to what we think will happen. We learn to appreciate, therefore, how the controls really work, what our role is in the flight process, and how to interact properly with the airplane. Integrating these elements and concentrating on flight from the pilot's perspective is what emergency maneuver training is all about.