Cover Article

Unusual Recoveries

From time to time, seemingly new unusual attitude recovery methods are introduced. How do alternative schemes compare to tried-and-true standards?

BY RICH STOWELL, MCFI-A

The mere mention of "unusual attitudes" not only raises eyebrows but—as pilots conjure up out-of-control airplanes plummeting from the sky—can measurably elevate stress levels. The phrase is often a catchall, including encounters with inadvertent stalls and spins, wake turbulence, and uncommanded spirals. Yet a stall by itself, though often a precursor to an unusual attitude event, is not an unusual attitude *per se*. For purposes of this two-part series, we'll divide our unusual attitudes into two subgroups:

Inadvertent spins, which are departures from controlled flight that involve simultaneously stalling and yawing; and airplane upsets, which are largely unstalled departures from controlled flight, especially those that involve excessive angles of bank. This month's article focuses on the inadvertent spin; Part II will focus on the airplane upset.

UNUSUAL ATTITUDE ENTRY

We can enter an unusual attitude an infinite number of ways. Ultimately, however, the unusual attitude will resolve into one of our two subtypes. From this standpoint, recovery procedures for full-blown unusual attitudes boil down to either a spin recovery, or a roll recovery. But before proceeding, the following points must be clarified:

First, early recognition of the conditions leading to an inadvertent spin or airplane upset is by far the most effective strategy. Unusual attitude events don't usually occur in a vacuum. Most are avoidable if pilots maintain awareness not only of the ever-changing flight environment, but of the control inputs they are making as well.

Second, no advertised recovery method can be mastered just by reading about it. Recovery actions—regardless of the method—involve exacting control manipulation perhaps contrary to the self-preservation instincts normally triggered by the stress of an unusual attitude. Scenario-based training in a controlled environment is the only surefire way to learn how to recognize the warning signs preceding an unusual attitude event, as well as to train the mind and body to react appropriately should an airplane depart from controlled flight.

Third, no unusual attitude recovery method can be claimed to be infallible. The farther an airplane is allowed to progress from controlled flight, the lower the probability of a

Spin-Recovery Methods, Old And New

Neutral Recovery Controls	Hands-Off	NASA Standard
1. Power: Off 2. All Controls: Neutralize	1. Power: Off 2. Hands: Off 3. Rudder: Full deflection opposite spin rotation	1. Power: Off 2. Ailerons: Neutral 3. Rudder: Full deflection opposite spin rotation 4. Elevator: Forward

Spin-Recovery Essentials

1. Recognition that the airplane has departed controlled flight;
2. The ability to think while under the duress of the unusual attitude and to switch into unusual attitude recovery mode;
3. The ability to control body movements precisely vis-à-vis the requirements of the specific recovery procedure;
4. The ability of recovery control actions to overcome spin dynamics;
5. Altitude in which to recover.

Critical Differences

Regardless of the spin recovery method learned, several factors are necessary for any inadvertent spin to have a successful outcome. These are summarized in "Spin-Recovery Essentials," above. Any bona fide and comprehensive spin training program addresses these issues.

It is through the repeated exposure to realistic spin scenarios that vital mental and physical skills are developed. Hence, what actually differentiates the three spin recovery methods boils down to a few critical differences in control placement.

For upright spins:

- Neutral Recovery Controls and NASA Standard both require the pilot to place the ailerons neutral; Hands-Off allows the ailerons to float, typically resulting in some in-spin aileron deflection during the spin.
- Neutral Recovery Controls and NASA Standard both require the pilot to move the elevator control briskly: only to neutral with Neutral Recovery Controls; in a worst-case scenario, fully forward with NASA Standard. Hands-Off, by contrast, allows the elevator to float freely, typically resulting in the stick/yoke settling aft of neutral during the spin.
- Neutral Recovery Controls requires the pilot to move the rudder briskly to its neutral position; Hands-Off and NASA Standard both require the pilot to move the rudder briskly as well, but fully against the spin.

successful outcome.

For example, one FAA study found that 93 percent of stall/spin accidents were initiated at or below traffic pattern altitude. At such an altitude, even if a pilot possesses spin recovery skills, it's already too late in the majority of cases. Similarly, even if altitude isn't a limiting factor, no method for spin recovery may be effective if a pilot exceeds the one-turn margin for error built into certificated, single-engine airplanes operating in the Normal category (and some of those airplanes when operating in the Utility category, too).

Assuming we have sufficient altitude for recovery, how do we know we've encountered an inadvertent spin? The FAA's 1976 Stall Awareness Training Study defined an inadvertent spin as an inadvertent stall, "followed by a change in bank angle of 60 degrees or a change in heading greater than 30 degrees."

Consistent with current spin resistance design criteria, we should add that spinning also requires a rate of change in bank or heading in excess of 90 degrees per second. Let's also say that in the case of an intentional spin, the spin becomes inadvertent the moment the pilot becomes disoriented, the moment the pilot's mind becomes disengaged from the physical actions taken by the body, or the moment the pilot decides to abort the spin.

WHAT'S OLD IS NEW AGAIN

The first spin recovery method to come about as a result of an empirical exploration of spinning came from the U.K. in 1916. The method called for shutting off the engine and placing the controls—aileron, elevator, rudder—in their neutral positions. Early airplane certification standards in the U.S. even required that all airplanes be recoverable from normal, six-turn spins with the power off and the controls neutralized. But that was quite a long time ago. Yet Neutral Recovery Controls has recently been resurrected as a panacea not just for inadvertent spins, but also for any unusual attitude. Advocates have been unequivocal in asserting that this method from the past is "bulletproof" and will recover any airplane "every time."

Another early yet short-lived certification standard required airplanes operating in the Acrobatic category to be recoverable from six-turn spins in not more than four additional turns after releasing all of the controls. In the 1980s, a derivative of this free-release technique was introduced to the aviation community.

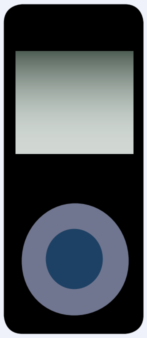
Known as the Hands-Off Method (among other names), pilots were instructed to close the throttle, take their hands completely off of the stick/yoke, and apply full rudder opposite to the spin. Articles introducing Hands-Off promoted it as an emergency spin recovery method that seemed to be applicable to most light airplanes.

Precursors to the NASA-standard spin recovery actions, on the other hand, were formally introduced in 1936. By 1964, Type Certification Spin Test Procedures explicitly listed these actions, stating, "All spin recoveries should be made using the NASA spin recovery technique [consisting of] ailerons in neutral position, full opposite rudder to stop rotation, followed by forward elevator control...." The document also states, "Evidence of an uncontrollable spin would be present if recovery cannot be effected...by using normal NASA control recovery movement." The procedure assumes that the throttle is set at idle.

Both the 1989 and 2003 versions of the Flight Test Guide for Certification of Part 23 Airplanes continued to recommend the NASA protocol to manufacturers and test pilots: "Recoveries should consist of throttle reduced to idle, ailerons neutralized, full opposite rudder, followed by forward elevator control...." Eighty-nine percent of FAA DER test pilots surveyed follow this very procedure during certification spin testing; the other 11 percent employ slight variants of the NASA protocol. Moreover, 94 percent of the test pilots believe NASA's standard to be the most effective for recovery in light, single-engine airplanes.

HEAR MORE HERE

For more on unusual attitude and spin recoveries, log onto our sister publication www.avweb.com and click the podcast button, then the podcast index.



This month's audiocast features an interview with Greg Lewis, Deputy Director of the National Test Pilot School, which conducts a wide variety of flight tests.

COMPARING RECOVERIES

Note that all three methods call for the power to be at idle during recovery. Interestingly, the revived Neutral Recovery Controls method as well as Hands-Off made headlines based on empirical observations in high performance aerobatic airplanes. Aerobatic airplanes, however, are designed with a much different mission in mind than non-aerobatic airplanes. For one thing, stricter spin standards apply for certification in the Acrobatic category. For another, a Pitts is not a fully loaded Cessna 206 on floats.

Neutral Recovery Controls assumes that pro-spin forces and moments can be overcome merely by eliminating pro-spin control inputs. Hands-Off assumes that full opposite rudder authority alone will thwart pro-spin dynamics. NASA Standard, by comparison, assumes that it will require the combined effect of full opposite rudder plus forward displacement of the elevator control to terminate rotation. From this standpoint, NASA Standard represents the highest order spin recovery method.

Confined to the proper context, the alternative techniques have undoubtedly helped some pilots out of trouble. But with all other things being equal, it's important to realize that in those instances where Neutral Recovery Controls or

Flying The Alternatives

I experimented with all three spin recovery methods in three spins-approved airplanes: a Cessna 150M, a Bellanca Standard Decathlon, and an Aviat Pitts S-2B. All spins were to the pilot's left. Here's how I did the experiments:

Scenario One (all three airplanes) involved a normal upright spin entered after a 1g deceleration with the power idle and the wings level. Spin entry was initiated in sequence with full left rudder, full aft elevator, and full left aileron. These inputs were held for two turns prior to initiating recovery inputs.

Scenario Two (Cessna 150M & Standard Decathlon) involved a normal upright spin entered from a skidded turn. The airplanes were established in level slow flight with partial power. A coordinated turn was started, followed by the application of left rudder and aft elevator to initiate spinning. Recovery inputs were applied as soon as the airplanes departed into the spins.

Scenario Three (Pitts S-2B only) involved an upright flat spin entered as follows: power off, wings level, one-g deceleration to stall buffet, full left rudder, full aft elevator. At one turn, nearly full power was applied followed by full right aileron. Inputs were then held for two additional turns prior to initiating recovery.

Scenario Four (Standard Decathlon only) involved a normal inverted spin entered from level inverted flight with the power idle. Full left rudder followed by full forward elevator initiated the spins. Inputs were held for two turns prior to recovery.

All three methods recovered the airplanes in the above scenarios for the specific weight and balance loadings of the experiment. Comparing the total altitude lost from spin entry through recovery to level flight, the first three scenarios were within 100 feet of each other. Scenario Four, however, saw the greatest differential in the total altitude lost between the methods: Neutral Recovery Controls consumed 1200 feet; Hands-Off, 1400 feet; NASA Standard, 1000 feet.

Even though the three methods happened to work in the above scenarios, it would be naïve to think that we could extrapolate the results to all spins in all light airplanes. Here's why:

The above experiment represents just a few data points in just a few spins-approved airplanes. A complete certification spin test matrix, covers many permutations of weight and balance, fuel load differential, entry conditions, control and flap positions and so on, can be several hundred points deep. Omitting a few data points—as in the above experiment—reveals far less about the efficacy of a particular technique than a "fail" reveals.

Hands-Off will recover an airplane from a spin, so too will NASA Standard effect recovery. The converse, however, is not true—many documented instances can be found where NASA Standard works, but the other schemes do not.

TROUBLE IN PARADISE

In the 1970s and '80s, NASA conducted the most extensive light airplane spin test program ever undertaken. Various spin recovery techniques were compared over the course of 8000 spin turns in four representative airplanes. Spins were allowed to develop for one, three, six, and in some cases, more than 10 turns. Spin entry conditions included various combinations of acceleration, roll, yaw, pitch, power, flap settings and landing gear position. The effects of mass distribution, limited center of gravity changes and control inputs were evaluated as well.

In AIAA Paper 86-2597, NASA concluded, "The results of the investigation confirmed the relative effectiveness of the [NASA Standard] recovery procedure, and it proved to be the most rapid technique for all the test aircraft." Compared to NASA Standard, Neutral Recovery Controls resulted in slower recoveries for the more fuselage-heavy mass distributions tested; it became completely ineffective with the more wing-heavy mass distributions.

AIAA Paper 93-0016 chronicles a spin test program using a Cessna 150J. The researcher evaluated the airplane's response to recovery inputs applied at the moment of spin departure as well as three seconds into the spin. Spins were performed for the no-flap and full-flap configurations.

Neutral Recovery Controls failed to stop the rotation. It didn't matter if the controls were neutralized immediately upon entry, or three seconds later. It didn't matter if the flaps were up or down. In the no-flaps case, spins were allowed to continue for three additional turns after neutralizing the controls. In the full-flaps case, spins were allowed to continue for six turns after neutralizing the controls. Reverting to NASA Standard recovery actions (with deployed flaps raised) terminated the spins.

As for Hands-Off, numerous reports of failed spin recovery attempts surfaced after the method's introduction, prompting a more cautious tone about its applicability. Airplanes in which Hands-Off is known to be undependable include the Cessna 150/152. Evidence in at least one fatal spin accident points to the application of Hands-Off to recover from an intentional spin in another airplane known not to respond to the method reliably—the Bellanca Super Decathlon.

Three Spin Phases

To test the various recovery methods, a full spin is required. Here are characteristics of the three different phases of a spin. Don't try this at home.

INCIPIENT SPIN

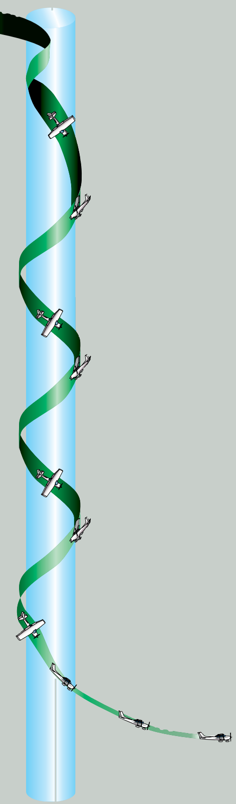
- Lasts about four to six seconds in the typical light aircraft
- Consists of approximately two turns.

FULLY DEVELOPED SPIN

- Airspeed, vertical descent rate and rotational rate are stabilized.
- The typical light aircraft will lose approximately 500 feet of altitude for each three-second rotation.

RECOVERY

- Wings regain lift.
- The typical training aircraft usually recovers in about ¼ to ½ of a turn once anti-spin control inputs are applied.



The accident flight involved a 600-hour Commercial pilot receiving dual instruction from a 1200-hour CFI. The training flight was to include a demonstration by the instructor of the Hands-Off method during an intentional, normal inverted spin. Several turns into the failed recovery attempt, the instructor called "bail out." The student successfully exited the airplane; the instructor did not. It appears the Hands-Off method was applied correctly, but to the wrong spin in the wrong airplane.

In an extraordinary display of courage, the surviving pilot visited the author to address the trauma of this tragic event, going so far as to perform a number of inverted spins with me in a Decathlon. NASA Standard recovery actions were used.

CONCLUSIONS

The alternative spin recovery methods are specialized techniques for special circumstances. In some spins in some airplanes—especially in the early stages—all three recovery methods may indeed be equally effective. The alternative methods, however, can become ineffective much sooner, or more often, compared to NASA Standard actions.

Perhaps the FAA's Flight Instructor Bulletin No. 18 sums it up best: During the incipient spin phase, "recoveries in those airplanes approved for intentional spins are usually rapid, and, in some airplanes, may occur merely by relaxing the pro-spin rudder and elevator deflections. However, positive spin recovery control inputs should be used regardless of the phase of the spin during which recovery is initiated."

The Law of Primacy postulates that what we learn first sticks with us. Whether it's an inadvertent spin from another maneuver, an intentional spin "gone bad," or even an intentional spin proceeding according to plan, pilots engaged in hands-on spin training should be exposed to NASA Standard recovery actions from the outset—a standard that has been validated and revalidated time and again over the last 70 years. From there it may be reasonable to branch out to special cases involving alternative techniques, provided that the context for deviating from the NASA Standard is spelled out.

The second and final part of this series will look at airplane upsets involving excessive angles of bank. Neutral Recovery Controls and Split-S recovery techniques will be compared to a more traditional roll recovery procedure.

Rich Stowell has provided more than 6800 hours of flight instruction teaching spins, emergency maneuvers, aerobatics and tailwheel transitions. His newest book, The Light Airplane Pilot's Guide to Stall/Spin Awareness, *was released earlier this year.*

Unusual Recoveries, II

From time to time, seemingly new recovery methods for unusual attitudes are introduced. How do alternative schemes compare to tried-and-true standards?

BY RICH STOWELL, MCFI-A

We compared the Neutral Recovery Controls and the Hands-Off methods of spin recovery to the tried-and-true NASA Standard recommendations in Part I of this series (June 2007). We'll now look at recovery strategies for airplane upsets specifically involving excessive angles of bank. Since leading supporters of Neutral Recovery Controls steadfastly maintain the method works in any attitude and in any airplane, we'll compare this strategy as well as the instinctive Split-S reaction (i.e., "Just pull, baby!") to a more traditional roll recovery as embodied in the Power-Push-Roll procedure.

To perform this comparison, the recovery strategies were put to the test during three familiar upset scenarios simulated at altitude. As was done in the spin experiments discussed last month, index marks were used in the airplanes tested to ensure accurate placement of the controls for the Neutral Recovery Controls method. Specific abort points were established for each scenario as well. The abort points represented the transitional instant from the normal flight mode into the unusual attitude recovery mode and the implementation of the particular recovery technique.

DESCENDING SPIRAL

The first upset scenario involved a steep, level turn to the left that was allowed to decay into a descending spiral. The Commercial Pilot Practical Test Standards (PTS) stipulate a 50-degree bank, plus or minus five degrees. Altitude variations must not exceed 100 feet. Consequently, the test airplanes were banked to approximately 55 degrees and allowed to descend 100 feet. Recovery actions were initiated as soon as the airplanes exceeded Commercial PTS limits.

A Cessna 150M was stabilized in level flight at 2500 rpm and just over 90 knots. The turn scenario was commenced. Since the 4G pull specified in the Neutral Recovery Controls method is inappropriate in the Cessna 150M, the pull was restricted to an estimated 2.5-to-3.0G tug on the yoke. This provided a similar margin to the Utility category design limit that a 4G pull provides in the Acrobatic category.

Neutral Recovery Controls resulted in a slight decrease in airspeed. Even so, the bank angle increased somewhat with no sign of recovery to wings-level flight; the airplane remained stuck in this spiraling limbo. Similarly, the Split-S method resulted in increasing bank angle and G-load trends with no sign of returning to level flight. Releasing the aft elevator input and rolling to wings-level promptly terminated these ongoing spirals. Power-Push-Roll, by comparison, required just 100 feet to return the airplane to level, controlled flight.

The same scenario was performed in a Standard Decathlon starting at 2300 rpm and 105 mph. Surprisingly, the 4G pull applied per the Neutral Recovery Controls method instigated a power-off loop that was tilted to the left. Just prior to triggering an accelerated stall in

To truly understand what's involved in recovering from unusual attitudes, you may need to get some acrobatic training. *See the sidebar at the bottom of page 10 for more information on UA training.*

ROLL RECOVERY METHODS

Neutral Recovery Controls	Split-S	Power–Push–Roll
1. Power: Off 2. All controls: Neutralize 3. Wait for 100 mph 4. Pull four Gs	Just pull, baby!	1. Power: As appropriate 2. Push: Unload Gs 3. Roll: Coordinated aileron and rudder inputs

ROLL RECOVERY ESSENTIALS

1. Recognition that the airplane has departed controlled flight;
2. The ability to think while under the duress of the unusual attitude and to switch into unusual attitude recovery mode;
3. The ability to control body movements precisely vis-à-vis the requirements of the specific recovery procedure;
4. The ability of recovery actions to return the airplane to level, upright flight without undue altitude loss, or without imposing potentially dangerous loads on the airplane and pilot; and
5. Altitude in which to recover.

CRITICAL DIFFERENCES

Regardless of the recovery method employed, several factors are necessary for any unplanned, overbanked attitude to have a successful outcome. These are summarized in "Roll-Recovery Essentials" above. Any bona fide and comprehensive upset training program addresses these issues.

this skewed loop—at which point, the airplane was in a nose-high, power-off, banked attitude—Neutral Recovery Controls was aborted in favor of releasing the aft elevator pressure and rolling the wings to level flight. The Split-S likewise failed to effect recovery. On the other hand, Power-Push-Roll returned the airplane to level, upright flight in 300 feet.

Next, the turn scenario was tried in a Pitts S-2B with the power initially set at 20 inches of manifold pressure. The Neutral Recovery Controls and Split-S techniques merely tightened the downward spirals; Power-Push-Roll recovered the airplane in 400 feet.

WAKE ENCOUNTER

This scenario involved a simulated wake turbulence encounter in the Standard Decathlon and the Pitts S-2B. The airplanes were first configured for slow flight similar to normal traffic pattern operations. A half snap roll to approximately 180 degrees of bank was used to simulate a worst-case encounter with wake turbulence. Recovery was initiated as the airplanes approached inverted.

The Decathlon was stabilized in level flight with 1800 rpm and approximately 75 mph prior to simulating the wake encounter. Neutral Recovery Controls consumed 500 feet to return to level, upright flight. The Split-S cost 400 feet, and the airplane experienced stall buffet throughout the recovery. Power-Push-Roll used 250 feet to reacquire level, upright flight.

The Pitts was established in level flight with 15 inches of manifold pressure resulting in about 100 mph. Both Neutral Recovery Controls and the Split-S methods consumed 1000 feet of altitude to return to upright flight. The heavy pulls dictated by these recovery schemes also resulted in significant stall buffet all the way around to level flight. Aggressive and continuous rudder action was required to prevent a spin departure in both cases. Power-Push-Roll, though, returned the airplane to level flight in 150 feet; furthermore, the airplane remained unstalled during the recovery.

An encounter with wake turbulence in the traffic pattern, especially one that rolls an airplane almost inverted, is indeed a dire situation. Recovery may be difficult or impossible given the deficiencies in speed, altitude and control authority inherent in traffic pattern operations, no matter what method is employed. Even so, it should be quite clear that the significant pulling advocated in Neutral Recovery Controls and the Split-S method is potentially a far more dangerous proposition than rolling toward level flight.

BOTCHED INVERTED FLIGHT

The last scenario replicated a low-time aerobatic pilot bungling an attempt at sustained inverted flight. A half roll was performed to establish inverted flight. The nose was then allowed to drop toward

Airplane Upset Training Aid Recovery Actions

Nose-High Recovery	Nose-Low Recovery
• Recognize and confirm the situation. • Disengage autopilot and autothrottle. • Apply as much as full nose-down elevator. • Apply appropriate nose-down stabilizer trim. • Reduce thrust (for underwing-mounted engines). • Roll to obtain a nose-down pitch rate.	• Recognize and confirm the situation. • Disengage autopilot and autothrottle. • Recover from stall, if necessary. • Roll in the shortest direction to wings level (unload and roll if bank angle is more than 90 degrees).
Completing The Recovery	
• When approaching the horizon, roll to wings level. • Check airspeed and adjust thrust. • Establish level pitch attitude.	• Apply nose-up elevator. • Apply stabilizer trim, if necessary. • Adjust thrust and drag as necessary.

the horizon line, at which point the inverted flight was aborted and the recovery process started.

The Decathlon was set in level, inverted flight at 80 mph and 1800 rpm. Forward elevator pressure was released and the nose fell toward the horizon. Neutral Recovery Controls required 700 feet for recovery; the Split-S, 800 feet. Noticeable grayout—the narrowing of the visual field, lightheadedness, and loss of color perception that often precede blackout and G-induced loss of consciousness—was experienced during both recoveries as well. By comparison, Power-Push-Roll required 400 feet, and no adverse physiological effects were felt.

Similarly, the Pitts S-2B was rolled to inverted and stabilized at 20 inches of manifold pressure prior to the simulation. Neutral Recovery Controls consumed 600 feet with the airplane buffeting in stalled flight throughout. Rapid rudder inputs were required to prevent spin entry.

The Split-S required 800 feet, with a peak load of five Gs and significant grayout. Power-Push-Roll, by contrast, required 200 feet. No stall buffet and no adverse physiological effects were encountered with this method.

For the three simple-yet-realistic scenarios tested, the traditional roll recovery technique clearly outperformed the alternatives. Neither Neutral Recovery Controls nor the Split-S returned any of the test airplanes to wings-level flight from the descending spirals.

Compared to Power-Push-Roll, the best the alternatives achieved in the wake turbulence scenario was still 1.6 times more altitude lost; the worst was a whopping 6.7 times more total altitude lost. Instances of potentially dangerous accelerated stall buffet and grayout were prevalent during recoveries using

Tackling UA Training Issues

Aviation Safety recently learned that an ad hoc group is forming to address various issues related to unusual attitude (UA) training in light airplanes.

The group—comprised of individuals and organizations concerned about often-inaccurate information disseminated on the subjects of stalls, spins and airplane upsets—will act as a resource for those interested in learning more about this specialized area of instruction. The group will also provide guidance to the aviation media regarding UA training techniques, including acting as a watchdog against the promulgation of dubious recovery methods as well as unusual attitude mythology. Long-term goals may include developing a voluntary set of standards for providers of UA training services.

For more information, contact MCFI-A Paul Ransbury via e-mail at <paul.ransbury@apstraining.com> or call 480-279-1881.

the alternative methods, too. For the scenarios investigated at least, Neutral Recovery Controls turned out to be nothing more than a glorified Split-S technique.

TRANSPORT CATEGORY UPSETS

We've focused primarily on unusual attitudes in light airplanes. Yet the need to provide upset recovery training to pilots of Transport category aircraft has become increasingly obvious in recent years as well. In fact, a consortium comprised of airplane manufacturers, airlines, pilot associations, flight training organizations and government regulatory agencies developed an "Airplane Upset Training Aid" for the airline industry. The training-aid CD contained text, slides, video presentations and a pilot's guide to airplane recovery. Also included was a sample upset training program with academics, simulator training exercises, and recurrent training exercises.

According to NASA's "Airplane Upset Training Evaluation Report," published in May 2002, several airlines have adapted this program for use in their training departments. The parallels to traditional light airplane upset recovery are unmistakable, especially the importance of pushing the elevator control forward and rolling to change the bank angle rather than pulling back on the elevator control.

NASA's upset training report identified several key issues that are relevant to airline and light airplane pilots alike. Among them are the importance of both book knowledge and hands-on proficiency, the use of rolling to recover the airplane during a banked upset and the effects of stress and surprise on pilot performance.

"Pilots in the midst of a full-blown airplane upset generally have one shot at recovery. Therefore, learning to implement the correct recovery actions—even if those actions might appear to take slightly longer to complete—is far more important than taking either immediate-but-inappropriate action...or no action whatsoever."

The report also acknowledged the vital role that repetitive practice plays in a pilot's ability to recognize a particular upset scenario, to understand the relationship of that scenario to the aircraft's energy state and to respond appropriately. Notice, too, this critical point: Pilots in the midst of a full-blown airplane upset generally have one shot at recovery. Therefore, learning to implement the correct recovery actions—even if those actions might appear to take slightly longer to complete—is far more important than taking either immediate-but-inappropriate action (i.e., flailing on the controls) or no action whatsoever (i.e., freezing at the controls).

SUMMARY

As was pointed out in Part I, early recognition of the conditions leading to an inadvertent spin or an airplane upset is the most effective strategy. The farther an airplane is allowed to progress into an unusual attitude, the lower the probability of a successful outcome.

Putting It All Together

It is through repeated exposure to realistic upset scenarios that vital mental and physical skills are developed. Thus, what differentiates the three recovery methods is mostly a philosophical difference in how best to deal with upsets where the defining attribute is bank angle.

The Neutral Recovery Controls method calls for idle power regardless of the upset attitude. Meanwhile, the Split-S response doesn't address power at all. Power-Push-Roll, by contrast, requires an awareness of the airplane's energy state: Nose-high with decreasing airspeed? Or low and slow in the traffic pattern? Power on in both cases. Nose-low with increasing airspeed? Power off.

Fundamentally, the Neutral Recovery Controls and Split-S techniques attempt to correct an overbanked attitude using the elevator as the primary recovery action. Consequently, higher sustained G loads can be expected with these methods.

The Neutral Recovery Controls method, in fact, specifies a 4G pull. Although this may be appropriate when operating in the Acrobatic category, a 4G pull is completely inappropriate when operating in the Utility and Normal categories (+4.4G and +3.8G design limits, respectively, flaps up; as low as 2G with flaps-down).

On the other hand, Power-Push-Roll addresses bank angle by focusing on the ailerons as the primary input and presumes a low-G environment.

Yet once an unusual attitude event is underway, traditional recovery methods remain the most effective across a wider range of airplanes and flying conditions. Alternative techniques may have their place, but the Law of Primacy again dictates that pilots learn the tried-and-true standards first. From there it might be worthwhile to discuss alternative methods, provided the context and their limited applicability are fully understood.

Recall, too, that no advertised recovery method can be mastered by reading about it. The recovery actions discussed in this series involve precise control movements that are often contrary to the self-preservation instincts triggered by a stressful situation. Scenario-based training in a controlled environment is the only way to learn how to recognize the warning signs preceding an unusual attitude event, as well as to train the mind and body to react appropriately should an airplane depart from controlled flight.

The number of ways airplanes can enter an unusual attitude are almost infinite. Nonetheless, unusual attitudes in light airplanes tend to resolve themselves into either a spin recovery or a roll recovery (i.e., a change in bank angle). The traditional methods developed to deal with these two eventualities have been around for a long, long time. Healthy skepticism, therefore, is warranted any time a so-called new, or simplified, or cure-all recovery method is offered to the aviation community.

Rich Stowell has provided more than 6800 hours of flight instruction teaching spins, emergency maneuvers, aerobatics and tailwheel transitions. His newest book, The Light Airplane Pilot's Guide to Stall/Spin Awareness, *was released earlier this year.*

Flight Planning's New Age

With the recent, ongoing upheaval at flight service, we can't count on a briefer's local knowledge or interpretation. Instead, we have to do it ourselves.

BY JOSEPH E. (JEB) BURNSIDE

Anyone who's picked up the phone to obtain a weather briefing from an FAA Flight Service Station (FSS) in recent weeks has discovered the ongoing consolidation by federal contractor Lockheed Martin (LockMart) isn't going so well. Lengthy hold times have been common, if the telephone is answered at all. Once a pilot gets to speak with a briefer, the service has been, shall we say, uneven. Recognizing this, the FAA recently announced a $3 million fine against LockMart for failing to live up to the terms of its contract.

We editorialized about these changes last month and had some in-depth conversations about LockMart's plans—to the extent they either had plans or were able to talk about them—with company representatives in a May 2005 article. Putting aside the many questions arising from what we consider the FAA's and LockMart's substantial breach of general aviation's trust and faith in this privatization and consolidation process, what's the average GA pilot to do? Sure, there's Duat and various other online weather and flight-planning services , and we've published several articles in recent months on what resources exist and how to use them. However, many of these alternatives are designed to supplement an FSS pre-flight briefing, not replace it.

What's missing from an alternative briefing—and what we've lost in the process—is a professional on the other end of the phone able

Beginning in 2005, Lockheed Martin took over the FAA's Flight Service Station facilities, pictured below, and recently began consolidation. Widespread service difficulties have forced many pilots to seek other pre-flight information sources.