CHAPTER 6

Control Systems Emergencies

When we learned to fly, we were taught to control the airplane by means of manipulating flight controls and engine controls. The flight controls are the ailerons, elevator, rudder, trim, and, on most airplanes, flaps. Engine controls in primary trainers are generally limited to the throttle and mixture; more complex aircraft have a propeller control, too. Complex piston-powered single-engine aircraft have retractable landing gear.

If any control device fails, the pilot is faced with an emergency of varying degrees of severity. Given his or her wishes, any pilot would rather have the flaps on a lightplane fail to come down rather than lose control of the elevator. But whichever luck you happen to draw, you need to be prepared to deal with it. Some of these failures can have dire consequences for the ill-trained or unprepared. With proper training, virtually all of the malfunctions are manageable, and the odds favor the airplane being landed without devastating injury to it or its occupants.

Don't hesitate to declare an emergency if any part of the control system fails. If you're working an ATC facility at the time, immediately tell the controller what is going on, but recall that control of the airplane is the first priority. If you are flying VFR and

not under any ATC control, you might want to consider getting in touch with a controller as soon as feasible. Landings with any measurable lack of control are risky, and, very candidly, an accident of some severity is likely.

I'd rather have an accident at a large, controlled airport for several reasons. (It isn't pleasant to muddle over these options and consequences, but they have to enter into whatever decision you make.) First, controlled airports probably have more than one runway, and crosswind landings should be avoided with most flight-control failures, which is subsequently detailed in this chapter. Second, controlled airports, particularly the large ones, are more likely to have fire and rescue personnel and equipment stationed right on the airport. The tower will know about the problem, and the rescue people will be ready to react immediately, probably following the airplane down the runway.

Lastly, large airports are usually associated with large cities, which have larger, better-equipped hospitals and perhaps specialized trauma centers close by. Studies have concluded that the chances of surviving serious injuries go up dramatically if a victim receives prompt treatment at a trauma center with medical staff trained and equipped to handle a life-threatening situation. This infamous "golden first hour" is more easily attained in a large metropolitan area rather than in a sparsely populated area. Allow yourself this edge if you can.

Ailerons

The ailerons serve to change the effective angle of attack of a portion of the wing, thereby either increasing or decreasing the lift produced by each wing. This change in lift causes the airplane to bank in one direction or the other. When we turn the control wheel to the left, or push the stick to the left, the aileron on the left wing is deflected upward, which decreases the angle of attack on the outer portion of the left wing, ahead of where that aileron is mounted. Simultaneously, the right aileron is deflected downward, which increases the angle of attack of the portion of the right wing ahead of that aileron; hence, the right wing produces more lift, and the left wing produces less lift. The

right wing goes up, the left wing goes down, and the airplane is in a bank to the left.

When a bank is established, the airplane starts to turn, assuming that the pilot is not crosscontrolling by applying rudder pressure opposite to the direction of bank. This turn is a product of lift acting perpendicular to the wings and "pulling" the airplane around in a turn in the direction of the bank. When we lower the left wing, we're also raising the right wing.

The right aileron, deflected downward into the relative wind, produces drag as it sticks down into the oncoming stream of air. Because the right aileron is producing a lift increase, the induced drag that is a by-product of lift increases with the increase in lift. Conversely, the aileron on the left side is deflected upward, which reduces the angle of attack, and therefore the lift, acting upon the left wing. Because leftside lift is being reduced, leftside induced drag is also being reduced.

All of these factors combine to result in "adverse yaw," which is the effect of the increased drag on the upward wing when the airplane is in a bank. When we want to turn left, we raise the right wing, and the drag acting on that wing wants to yaw the airplane to the right. But we want to turn left. To counteract the adverse yaw, we apply a little left rudder pressure, and the yaw inputs equalize, allowing the airplane to smoothly enter a left bank and left turn. Primary training covered this "coordinated-turn entry," but many pilots did not learn the real reason for using rudder to enter and recover from turns.

The control wheel is attached to cables in most lightplanes which in turn run out through the wings. These cables then attach to bellcranks, which are attached to the ailerons, raising or lowering an aileron in response to the input from the wheel in the cockpit. There are lots of opportunities for failure in this mechanical system, but, thankfully, such problems are rare. During each 100-hour or annual inspection, all cables and connections are thoroughly examined, and components are replaced or repaired as needed. Almost all pilots fly for an entire career without thinking about a failure in this system because manufacturers and mechanics routinely do a very good job of designing, manufacturing, and maintaining aircraft.

Aileron control failures are very rare because the amount of physical force put on the system is fairly light. You don't deflect an aileron very much to get the job of banking done, so there isn't much load put on the system, unless you're flying aerobatics.

If I had to lose control of a primary flight control—rudder, elevator, or aileron—I'd choose the elevator. But failure of the aileron system is not that much more difficult to deal with and be able to manage nearly normal flight; however, adaptations in how you approach flying the airplane have to be made. If an aileron jams in a deflected position, that's another story.

If the failure is a breakage or disconnection of the cables, or in a very few airplanes, the pushrods that connect the control wheel to each aileron, the ailerons will simply trim themselves in line with the trailing edge of the wing. You won't be able to use them to bank, but you can still turn the airplane, and in turning, you'll get some angle of bank.

When you can't deflect an aileron, turns must be made with the rudder. Try it sometime at a safe altitude, and you'll see that it's weird at first, but it does work. The turn entry will be uncoordinated and sloppy, accompanied by less than precise yawing. As the turn progresses, you'll have to constantly work your feet on the rudder pedals to keep the turn and the ensuing bank angle under control.

Make such turns gingerly to allow for the delayed action of rudder-pressure-producing bank to take effect. You don't want to overcontrol and allow precipitous bank angles to develop. Make the turns shallow and take your time, and you'll be able to turn all right. The rudder is the only means that you have to keep the wings level in between turns. Again, slight control pressures are the answer. Accept the fact that control will be imprecise, and concentrate on being as smooth and gentle as possible.

The rudder will be used for several things. It's your only control for entering, maintaining, and recovering from turns. Allow plenty of time for recovery from a turn; therefore, keep the pedal pressures light. During a turn, especially if you need to change heading more than about 45° or so, be ready to use opposite rudder to keep the angle of bank from becoming too steep. Naturally, use rudder into the

CHAPTER 7

Water Landings

Landing in the water is a frightening experience to all who have either endured it or thought much about it. Before we get into the nitty-gritty details of ditching, let's talk about overwater flying.

When you choose to fly over water, out of gliding range of land, you increase the risk associated with flying. This statement isn't meant to overly discourage overwater operations; it simply states a reality. Pilots who fly in the continental United States never have to fly over water for any great distances. Sometimes a direct routing between two places might be over one of the Great Lakes or out along the coastlines of either the East or West Coasts farther than you could glide back to shore. For sure, you'll be doing some real overwater flying if you tour the Bahamas or elsewhere in the Caribbean.

There is more to know about overwater flying than just how to ditch an airplane into the water. There are several additional precautions to take and more knowledge to gain. Get some good books on the subject. Talk to experienced pilots who have "been there, done that."

Many pilots haven't filed a VFR flight plan since they were students. I'll confess that I seldom do for routine trips in good

Always file a flight plan when your route takes you over water.

weather. But when you venture out over the water, think again. Prompt rescue is your key to survival after you successfully negotiate a ditching. One way to get the search process begun early is to file a flight plan. If the route of any flight takes you into the coastal or domestic ADIZ/DEWIZ, filing a defense VFR (DVFR) flight plan is legally required. If you neglect to follow the rules, you'll be intercepted by either a military fighter, the Drug Enforcement Administration, or the U.S. Customs Service. Meeting these fellows is not a pleasant way to either begin or end a vacation in the sun. They will lead you to a landing at a place where you'd rather not be, and then you get to answer some really embarrassing questions. You might also get to help retire a portion of the national debt with the monetary penalties that are imposed for disobeying the rules.

Neither this book nor this chapter is dedicated to covering the U.S. Customs requirements for private aircraft leaving or reentering the United States. But if you do fly an international trip, know what's expected and how to do it. Back in the early 1970s, I owned a Piper Aztec that we occasionally took south. On one trip, we went over to the Bahamas for a day. Coming back, we landed at West Palm Beach to clear customs.

Aztecs have a nose baggage compartment in addition to a compartment behind the seats. In those days, radios weren't solid state, so the nose compartment was full of amplifiers, tuners, and other tubes and boxes. We never used it for baggage. But because it was equipped with a door, the customs inspector wanted to see inside. I didn't even have a key to it on my key ring.

The inspector gave me two options: produce the key or drill out the lock. Drilling the lock would have grounded the airplane for at least a couple of days while we found a mechanic and rounded up the parts to fix it. As usual, my wife saved the day because she thought ahead and had a key with her. After he snooped till his heart was content, he was satisfied that we weren't drug lords, and we were on our way home.

Even if a flight plan isn't required by the FARs or Customs regulations, always file one for any overwater flight. Even in relatively warm water, your survival time is limited if you have to ditch, so give

yourself a break by filing a VFR flight plan. The search-and-rescue system (SAR) will be activated if you don't close a VFR flight plan within 30 minutes of your ETA. Without a flight plan, someone has to start the SAR process. That person is usually some business associate who gets worried because you didn't make it to a meeting. Sometimes, a frightened family member gets to make the call to the missing persons bureau of the police department when you don't get home on time.

Regardless, if you don't file a flight plan, it will be several more hours for sure and maybe even a day or two until SAR gets notified that you are missing, and the system gets the search for you underway. Then searchers have no real idea of where you went down along your route of flight. The search process must cover all of the area from your point of departure all of the way to your intended destination. That prospect ought to be enough to motivate anyone to file a flight plan for any overwater flight.

Always fly as high as practical on overwater flights, trying to stay within gliding range of land. That might not be possible, depending on the weather and the performance of your airplane. Even when flying along the shoreline, there isn't any need to fly so low that you can't make the beach if you lose the engine. Then consider the nature of the shore near you. If it's strewn with rocks or cliffs, it's not an acceptable forced-landing site anyhow. In that case, maybe flying a little higher would allow you to glide over the shore to a forced-landing site just inland. A decent field might be farther inland, necessitating an even higher altitude to remain within gliding distance of it.

The other option to ditching is to avoid overwater routing when possible and add a few minutes to your flight. Even if the distance adds 50 miles or so to a trip, that's less than 30 minutes in all but the slowest of airplanes. As we've repeatedly said, flying is an exercise in risk assessment and acceptance. Use your own judgment about flying over water, out of gliding range of a suitable shoreline or other place to land. I do my utmost to avoid it.

Flying overwater can have other risks, especially for the pilot who doesn't have an instrument rating. On some days, the horizon over water will be as distinct as it is over land. At other times, it can get very murky and disappear completely.