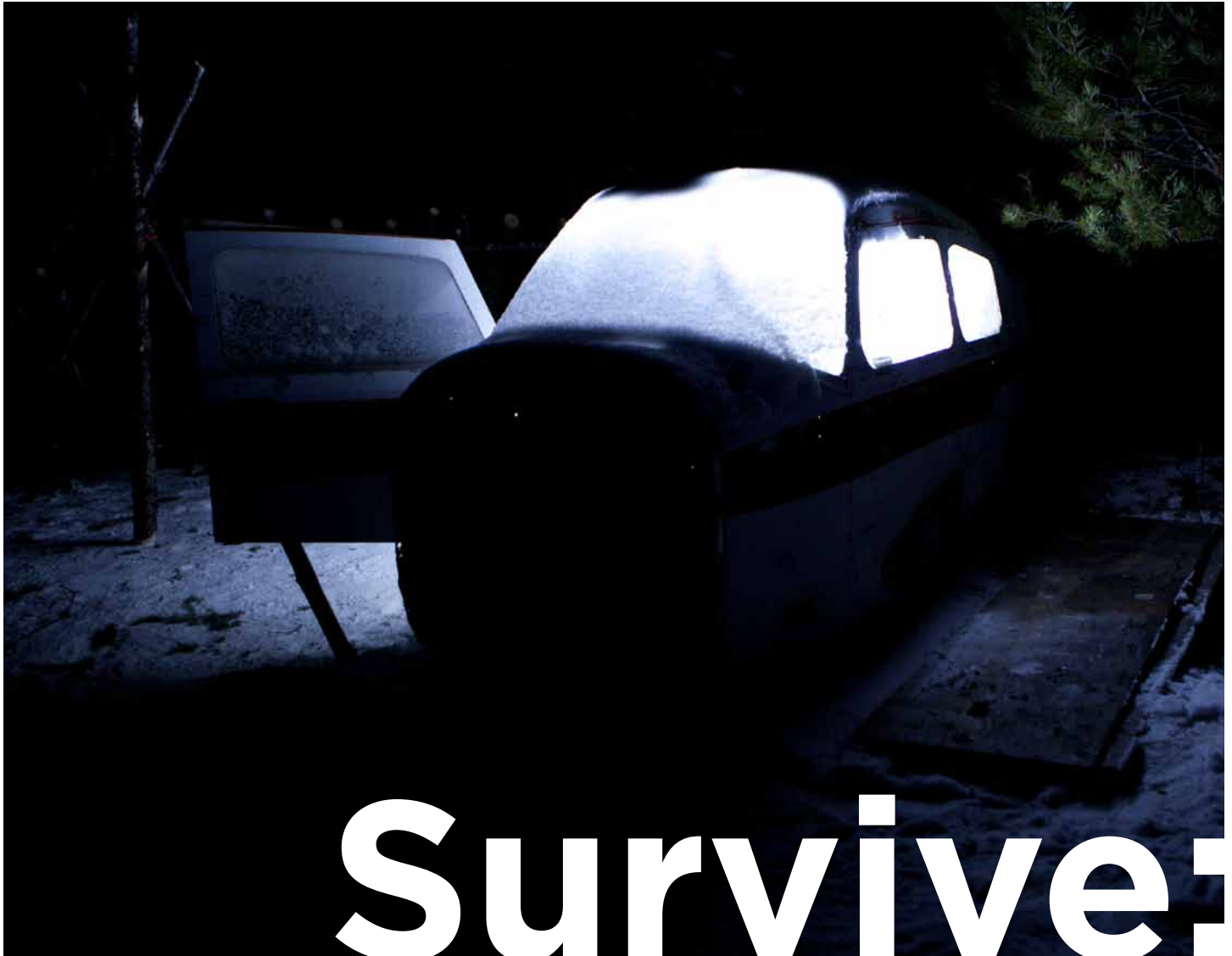




SAFETY ADVISOR

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Beyond the Forced Landing

This project is funded by the Canadian Owners and Pilots Association and the Donner Canadian Foundation. While the goal is to help Canadian pilots understand regulations concerning carrying survival equipment in-flight, it is intended to help all pilots better understand what they can do above and beyond the regulations to survive an accident.

Six months after an airplane went missing

in April 2014, a hiker chanced across the wreckage in a heavily wooded area. It was just 8 km (5 mi) from where it took off, less than an hour from its intended destination and only about 275 m (300 yds) from a roadway. Where did this happen? In flat, sunny, densely populated Florida within 65 nm of downtown Tampa. The time it took to find the forced landing site should make everyone reconsider their assumptions about survival and rescue.

Pilots can take away three major lessons from this and similar accidents:

1. Worst-case preparation matters.

Planning your route, having the right clothing, and briefing everyone onboard about where to find and how to use survival and rescue gear can significantly influence the outcome of a forced landing in your favor. Even so, eventual rescue can take a significant amount of time.

2. Communication is critical

throughout. A good flight plan, keeping others in the loop on your whereabouts, and taking advantage of ATC services can improve your chances of being found. The more others know about your intended flight path and proposed departure and arrival times, the shorter you will likely await rescue.

3. Training and actions can

determine your fate. Every emergency is different and everyone will respond differently, but good training generally yields better results. Basic survival knowledge and the right equipment can help you better control your fate.

In Canada, the rules for carrying certain survival equipment used to be mandatory, but several years ago they changed to allow pilots greater discretion (see pg 2, CAR 602.61 Survival Equipment-Flights Over Land). In some ways, the change can be viewed as a good one. It is better to prepare and carry equipment because you know and understand the risks than because government regulations compel you.

Many pilots, however, are likely interpreting section 2(e) liberally, which is not in their best interest.

The important thing is to conform the rules and your discretion to the type of flying you do.

Prepare for Credible Contingencies

We all fly in different conditions over different parts of the country for different reasons. Basically, every flight presents its own credible forced landing scenarios and risk profiles. Unplanned off-airport landings and crashes often result in serious injuries as well as fatalities that disproportionately affect the people in the front of the plane (see pg 3, Injury Statistics Provide Insights).

The choices you make before takeoff can make a big difference when it comes to survival and rescue. Before turning the key, ask yourself if you've done everything and brought everything you will need to mitigate

CAR 602.61 Survival Equipment—Flights Over Land

(1) Subject to subsection (2), no person shall operate an aircraft over land unless there is carried on board survival equipment, sufficient for the survival on the ground of each person on board, given the geographical area, the season of the year and anticipated seasonal climatic variations, that provides the means for

- (a) starting a fire;
- (b) providing shelter;
- (c) providing or purifying water; and
- (d) visually signaling distress.

(2) Subsection (1) does not apply in respect of

- (a) a balloon, a glider, a hang glider, a gyroplane or an ultra-light aeroplane;
- (b) an aircraft that is operated within 25 nautical miles of the aerodrome of departure and that has the capability of radio communication with a surface-based radio station for the duration of the flight;
- (c) a multi-engined aircraft that is operated south of 66° 30' north latitude
 - (i) in IFR flight within controlled airspace, or
 - (ii) along designated air routes;
- (d) an aircraft that is operated by an air operator, where the aircraft is equipped with equipment specified in the air operator's company operations manual, but not with the equipment required by subsection (1); or
- (e) an aircraft that is operated in a geographical area where and at a time of year when the survival of the persons on board is not jeopardized.

the risks. Play the What If... game. What if I crash? Have I briefed the crew and passengers? Did I pick the safest route? Am I prepared?

Your survival plan should be as meaningful as your flight plan so verify you have the right preparation and right gear before you take off.

Gearing Up for Survival

If you are flying over terrain that is at all rugged or remote, consider wearing a survival vest that has enough pockets to carry communication and signaling devices, multi-tool, flashlight, first-aid kit, water, compass, fire-starter materials, batteries, maps/sectionals with your GPS coordinates, paracord, and some type of shelter. Make a

habit of restocking and checking it before flights. (A checklist of recommended items is at the end of the article.)

Your vest can only carry so much, so put together a survival kit that meets the needs for the type of flying you do and number of passengers you carry. Build customized modules to accommodate longer trips, more difficult terrain, cold or wet weather, or additional people. Before each flight, ask yourself whether your kit matches the nature of flight you are about to take with particular attention to season, terrain, and passengers.

If your vest becomes so laden with gear you don't wear it, or your kit grows too large and cumbersome

to carry, balance the potential need with the size and weight. Just remember you may be trading short-term comfort for survival. You could also apply the 80/20 rule by asking yourself what is the 20 percent of the kit that will get you through 80 percent of the emergencies. Of course, you may streamline your kit, but later discover that what you removed was something you vitally needed.

Surviving Impact

Obviously, successful rescue first requires that you survive the forced landing. The foremost thing to do is to make sure you and your passengers are always strapped in. Wear your seatbelt and shoulder harness or, better yet, have a five-

(Continued on pg 4)



In Canada, nearly one-fifth of the fatalities were the result of a single injury.

Injury Statistics Provide Insights

Knowing some statistics about typical forced landings and their outcomes can help you plan how to survive an accident. In the five-year period from 2009-2013, the average number of annual aviation accidents in Canada was 285 with an average 59 deaths. Statistics are similar in the U.S., with 10-20% of aircraft accidents resulting in fatalities.

In Canada, nearly one-fifth of the fatalities were the result of a single injury. And of these, nearly one-third were head injuries. The takeaway for pilots: Protecting your head is perhaps the single most lifesaving action you can take.

Transportation Safety Board of Canada Statistical Summary - Aviation Occurrences 2013

(Continued from pg 2)

point restraint system and airbags. As the statistics show, anything you can do to avoid a head injury will increase your chance of survival.

Your cargo should be strapped in as well, particularly heavy objects. The longer the trip and the more hastily you pack, the more attention you

While stalling the plane may sound like a good way to attain the slowest possible speed, it also results in more downward forces that are far more dangerous. The human body can tolerate about 45Gs of forward deceleration, 20Gs side-to-side. But it can only tolerate about 15Gs of downward deceleration, or force,

www.airsafetyinstitute.org/passengerbriefing.

If there is a fire, your only reliable survival gear may be what you are wearing. Dress for the terrain and weather conditions you will be flying over rather than your departure or destination.

Because of the risk of fire
and the need for quick evacuation from
the aircraft, your only reliable survival
gear may be what you are wearing and
carrying on your person.

should give to strapping in gear. In a 20G crash, a 2kg (4.4lbs) camera bag becomes a 40kg (88lbs) projectile.

Many variables affect the energy of the actual crash, but crash-related injuries are caused by deceleration-related impacts and forces. More specifically, kinetic energy goes up as the square of the velocity. In other words, minimizing your groundspeed before contact with the ground is critical, though not so critical that you should do anything that produces excessive downward forces, like stalling the wing.

To reduce injuries, it is best to spread your deceleration over a longer distance. Hitting at a low angle and dissipating energy over as much distance as possible will minimize the G load of the crash. For example, an aircraft traveling at 60 knots that comes to a stop over 3 m (9.8 ft) generates about 18Gs of deceleration. If that same energy was spread over 9 m (29.5 ft) it would reduce deceleration to 5Gs.

which commonly results in spinal injuries. You and your body are better off accepting forward Gs vs. the downward Gs brought on by a stall.

Post-impact Fire

Post-impact fire—from breached fuel tanks, live electrical systems, and hot engine parts—is a serious concern. It is one reason we are taught to turn off electrical and fuel systems before impact. In addition, opening your door slightly before impact will help ensure your quick egress.

After the forced landing, if you smell fuel or see smoke, it is critically important to evacuate the aircraft even though it can be risky to move injured parties. A handy fire extinguisher within easy reach of the pilot seat may provide the critical seconds you need. Better still is briefing your passengers about where it is located before takeoff. Briefing everyone is for your safety as well as theirs. For more information, see the AOPA Passenger Safety Briefing video—the critical information your passengers need to know:

Worst-case Scenarios are When Your SAGA Begins

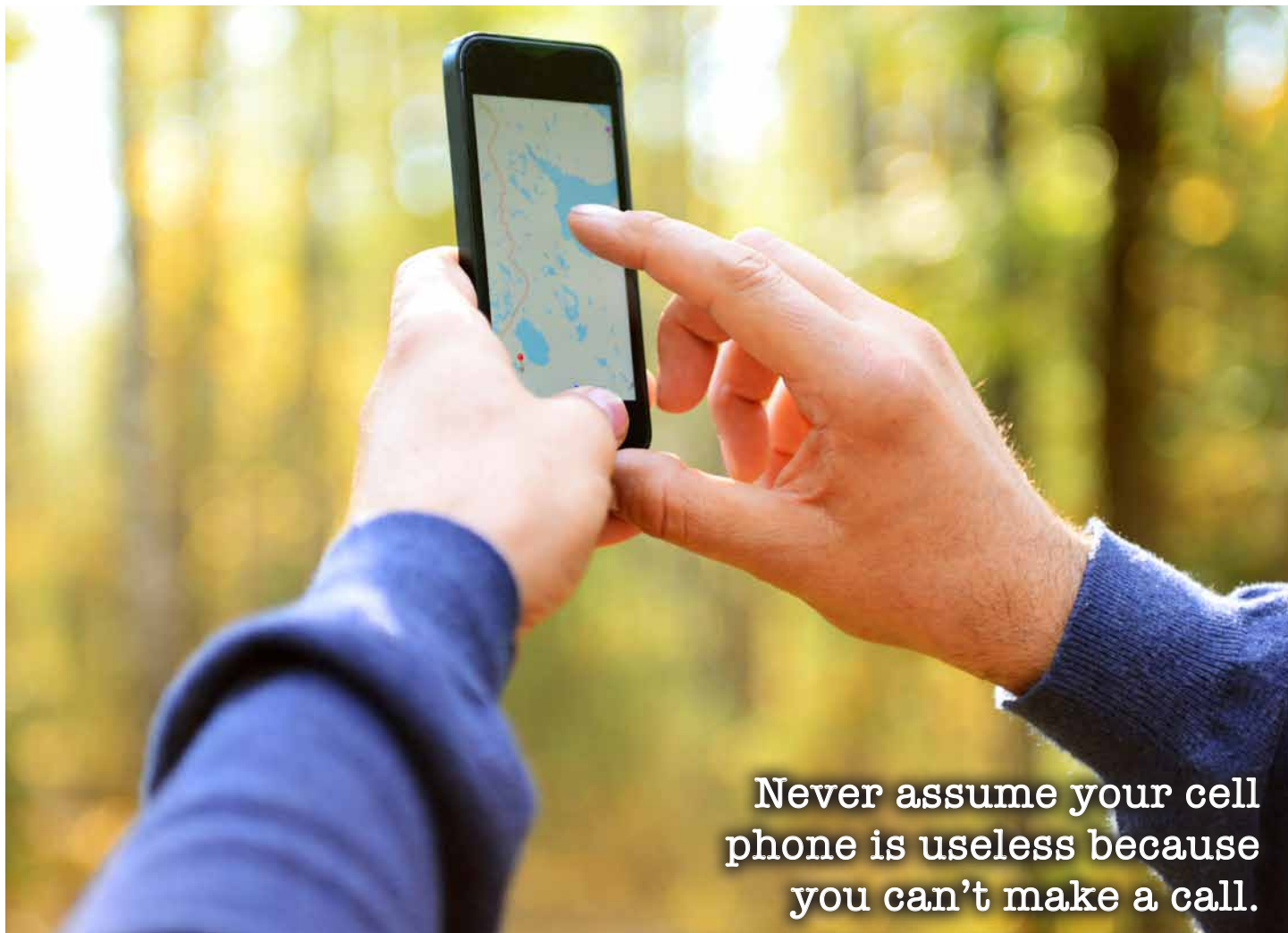
A mantra worth knowing and repeating is SAGA, which stands for Stabilize, Assess, Gather, and Act. Iteratively going through each step—from post-impact stabilization, through the golden hour of assessment and reporting, to gathering supplies and acting thoughtfully until rescue—will give you the best chance for survival after a forced landing.

(S) Stabilize

Immediately after a forced landing while you are still disoriented from impact, the situation can go from bad to worse very quickly. Your first act will be instinctive, regaining awareness of your own immediate situation. But once you're in control, focus on stabilizing immediate life-threatening situations. Extricating everyone from the aircraft and dealing with critical injuries will be of paramount priority.

When people are pinned or too injured for quick or safe extrication, a fire extinguisher readily at hand may provide lifesaving seconds.

(Continued on pg 6)



The Power of a Cell Phone

Never hesitate to use your cell phone to dial 911. A 911 call will relay signal from any available tower regardless of provider. No signal on your cell phone just means your particular provider has no coverage in the area.

Never assume your cell phone is useless because you can't make a call. Try a text. They often work when the signal is weak. Stick to the basics; for example, "SOS plane crash, 51deg 47min 30sec N 113deg 30min 30sec, blue plane, green tent, 3 people, 2 injrd, call 911."

Even if you can't send a meaningful message, a cell phone may still have enough power to send data packets as it attempts to log into a network. Attempted but failed log-ins could be enough to help rescuers pin down your location by looking for transmissions from your phone number.

In cold environments, use your body warmth to keep communication devices warm and conserve battery life. Carefully ration your battery life and only periodically turn on your cell phone.

(Continued from pg 4)

Since crew are more likely to be incapacitated than passengers, this is where your pre-takeoff briefing about where the fire extinguisher and survival gear are located and how to use them will improve everyone's safety.

Assessing exposure means identifying injuries that may be hidden by clothing. But in a forced landing situation, it can also mean assessing how exposure to the elements and the dangers at the site might affect survival.

details that will help rescuers locate you, like the color of your aircraft, tent, clothing, etc.
7. Your plan of action, like starting a fire, walking to a nearby road or staying put
8. Your emergency contact

Call emergency personnel first,
before any other contact. Stay calm. If you can, jot down your information before you call so it is prioritized...

(A) Assess and Report Your Situation

When you know the danger of fire is gone, or you have evacuated to a more stable location, it is time to make a more general assessment of the post-crash scene and attempt rescue communications. Emergency medicine calls this the golden hour. If you don't have at least basic first-aid training, you should consider taking it so you are familiar with the ABCDEs (Airway, Breathing and Circulation, Disability, Exposure). These provide a quick way to triage and stabilize life-threatening medical situations. Disability and Exposure, the last of the ABCDEs, are especially important factors in a post-crash situation.

Assessing disability involves identifying who can help at the scene and who will need ongoing assistance or regular check-ins to verify their condition isn't worsening. People who are initially lucid may not stay that way. Head injuries typically result in cognitive impairment ranging from disorientation to unconsciousness. If you have narcotic or related painkillers in your first-aid kit, do not give them to people with impaired cognitive function.

The first hour is also the golden hour for eventual rescue. The sooner first responders start looking for you, the sooner you will be found and attended to. Activate your Personal Locator Beacon (PLB) if you have one, use your radio, and try to make a call out with your cell or satellite phone (see pg 5, The Power of a Cell Phone). You may not be able to reach air traffic control (ATC) now that you are on the ground, but you may be able to hail aircraft passing overhead, including jet traffic. Try 121.5 or even the control center frequency for the area.

Call emergency personnel first, before any other contact. Stay calm. If you can, jot down your information before you call so it is prioritized:

1. Your name
2. Location of the site, including coordinates if you have them
3. Any other location details, like "on a south facing slope"
4. Number of people involved and extent of injuries
5. Survival equipment if you have it
6. Any descriptive or signaling

All the while, you should be continuously assessing your situation and identifying the most pressing issues that will jeopardize your safety. Cold, wet, or windy weather makes exposure and hypothermia an immediate risk. Students of survival classes often report how fast they get cold without proper clothing or protection. If your clothing is unsuitable, your most immediate priority may be to put on more appropriate clothing or build a fire or shelter.

(G) Gather

At first, you should focus on gathering the items needed to stabilize and get through the first hour: proper clothing, first-aid supplies if people are injured, communications, and, if necessary, equipment to manage an existing fire.

Next you should gather the resources you need to remain safe and assist in your rescue, like water, food, shelter, fire starter, extra clothing, and any other creature comforts that will make your wait as comfortable as possible. This is also the time to collect items for

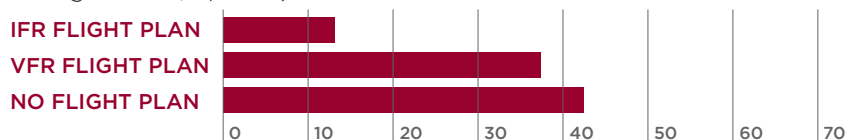
(Continued on pg 8)



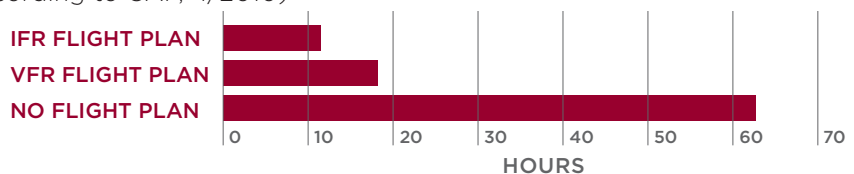
Flight Plans Can Shorten Wait Times

Filing a flight plan is always a good idea. Sure, it pins you into specific routing restricting your freedom to wander, but that is precisely what makes you easier to find. If you don't file, be prepared to wait. Statistics on wait times show variability based on the data source, but they have one common element: No flight plan equals a longer wait.

Flight Plan Average Time from Last Known Position to Rescue
(according to FAA, 11/2010)



Flight Plan Average Time from Last Known Position to Rescue
(according to CAP, 4/2010)



(Continued from pg 6)

signaling. Rescue efforts can take time to mobilize, so you should count on spending the night.

All the while, continually identify and prioritize threatening issues and gather the items you need to address them. Some priorities

Your focus should remain on meeting basic survival needs and establishing rescue communications. It doesn't matter what circumstances led to your forced landing so don't beat yourself up. Stabilize yourself and others, assess injuries and the survival environment, gather resources, and

the manual so you know how it works. Some come with portable antennas attached to the box. If you crash and the installed antenna cable is severed or the main antenna is sheared off, it is good to know there is a backup and how to use it.

may be immediate, like locating and donning weather gear. Others may be less obvious, like finding a flashlight while it is still light out. Still others may be ongoing, like attending to injuries. The circumstances of every forced landing are so different there is no cookie cutter formula.

(A) Act

Act is last in the SAGA mantra because it is important to act with purpose and within the limitations of your skills and physical abilities rather than act for the sake of doing something. In emergency situations, people often act in haste and end up making their situation worse, causing injuries or draining resources. The hardest part of acting is the act of waiting.

The rule of thumb is to remain at or near the forced landing site and conserve your energy. Sometimes there is a compelling reason to leave—unstable terrain, lack of shelter, a tree canopy that makes the site invisible from the air when there is a meadow nearby. But unless there is a good reason, don't venture too far. Preserve your resources.

act to address threatening issues and priority items. Then you can shift your focus to the next 24 hours and beyond. Basically, your SAGA will continue until you are rescued.

Enhance Your Communication Options

Your best bet is to carry an array of communication devices and know how to use them. The best-case forced landing scenario is one where ATC heard your mayday call, your last known position is on radar, your Emergency Locator Transmitter (ELT) activated at impact and started sending a distress signal, your cell phone is fully functional, and your emergency contact knows when to assume things went wrong and who to contact to begin search and rescue. Unfortunately, if you just had a forced landing, things are clearly not going according to plan (see pg 7, Flight Plans Can Shorten Wait Times).

Your ELT is your cry for help even in the event you are unconscious. But don't assume your ELT is properly installed and working. Check it before your flight and during maintenance inspections to increase the likelihood it will work when you need it. Read

The rule of thumb is to remain at or near the forced landing site and conserve your energy.

There are a whole slew of reasons why you shouldn't rely on an ELT as your main emergency signal. A signal may not get out if it doesn't survive a post-impact fire or has an antenna that is broken or covered with debris.

A 406 MHz PLB can relay distress signals directly to search and rescue via satellite. Not all PLBs are created equal. Those with integrated GPS systems provide detailed location information and will help rescuers pinpoint your location within 100 m if the GPS antenna has a clear view. Non-GPS PLBs rely on satellite-based position fixes that are less accurate (within a few kilometers or miles).

Satellite messengers like SPOT, SpyderTracks, and InReach are handy for rescue communications, but unlike PLBs do not automatically notify international search-and-rescue authorities. The capabilities and rescue response protocols are brand- and model-specific. Both PLBs and satellite messengers need to be manually activated, so whatever device you choose to carry, keep it within arms reach. Just like your fire extinguisher, briefing your passengers about where it is and how to use it is

(Continued on pg 10)



PHOTO BY MIKE HART

Survival Vest Contents

- Communication device (one or more of the following): a personal locator beacon (PLB), radio, cell phone and a spare battery
 - Signaling device (one or more of the following): signal mirror, whistle, strobe, chemical lightsticks
 - Headlamp or flashlight (preferably LED with strobe option)
 - Water flask
 - Fire starter: Flint/steel based fire starter, weatherproof matches, petroleum jelly-soaked cotton or other tinder
 - Shelter: pocket bivvy shelter, all-weather blanket, nylon poncho or plastic sheet
 - Paracord
 - Basic first-aid kit
 - Knife/multi-tool/survival saw
 - Compass
 - Food: granola bars, candy, nuts
 - Hat (wool or synthetic balaclava)
 - Gloves (insulated, leather or neoprene)
- Additional items:**
- Water purification tablets
 - Pencil or pen, good for leaving notes
 - Maps/sectionals
 - Sunscreen, lip protection
 - Chemical hand warmer
 - Bear spray, insect repellent

(Continued from pg 8)

for your safety as well as theirs. A satellite phone allows you to share even more details. Remember that phones or text-based communications require some presence of mind so important details aren't left out if a call ends prematurely due to battery life or reception.

For ground-to-air signaling, right angles and sharp corners will stand out to rescuers as will bright contrasting colors, such as orange and yellow, or black dirt or objects on a white snow. The shape of your signal can also communicate information. A large V indicates

metabolic drain to your body adds another risk to compete with dehydration. In the absence of any other water source, however, it may be your only option.

Drinkable water must be found within 24 hours after a forced landing or

The longer you remain in good spirits,
the better you can make good decisions and stay alert. Little comforts stashed in your survival vest...
make a huge difference in keeping a positive attitude and staying focused.

More and more pilots are going paperless and using Electronic Flight Bags (EFBs). These can help pinpoint your position provided you have sufficient battery power. Gadget-dependent pilots should consider carrying an external USB battery that can recharge a cell phone, iPad, or typical EFB.

Even in a paperless world, however, it is amazing how handy a pen and paper can be for survival and rescue. Without them, it is hard to leave a note that you left the site for a nearby road.

Signal with High Contrast, Flashing Light, and Sound

Don't forget the value of signaling. When you hear rescue aircraft, don't stop trying to get their attention until you know they have seen you. Signal fires, flares, rescue strobes, beacons, signal mirrors, whistles and air horns, and even waving a shirt will make it easier for them to find you. A properly used signal mirror, even a CD or DVD, can be spotted from more than 100 km (62.1 mi).

you need help, X indicates injury, and an arrow can help point to your campsite or the actual site. Remember, bigger is always better.

Morale and Other Keys to Surviving the Wait

We're often told the three most critical keys to survival in any scenario are water, protection from the elements, and food. The most critical factor, however, is your attitude. Much of the time waiting for rescue involves doing nothing, which can dull the senses and make you less aware of your surroundings or incipient threats. The longer you remain in good spirits, the better you can make good decisions and stay alert. Little comforts stashed in your survival vest, like a toothbrush, toilet paper, candies, a pack of cards, or knot-tying book, can make a huge difference in keeping a positive attitude and staying focused.

Water

A lack of water is a universal threat to survival, particularly in cold weather where signs of dehydration can be easily overlooked. Eating snow is usually not a good option because hypothermia from the

your survival could depend on your cleverness at extracting water from plants, wet materials, or condensation. It is far easier to carry an extra gallon or two in the plane, or a canteen or water bladder for each individual aboard the aircraft, ideally a day's supply for each person. That gives you and your passengers some extra time.

If you find a source of running water, it is generally a good idea to treat it to remove protozoa, bacteria, and viruses. The most inexpensive portable treatment systems are halogen-based water purifying tablets, usually made of chlorine or iodine. Filters can also be effective. A more potent option is ultraviolet light, but it requires electricity, so it will only work as long as there are batteries or a charge.

Boiling water is the classic option for producing safe drinking water. It has drawbacks—it uses fuel, time, and resources—but in the event of a cold-climate forced landing, it may be the best or only means of obtaining drinkable water, particularly from snow or ice. Additionally, a hot water bottle in your sleeping bag or next to your skin can stave off cold.

(Continued on pg 12)

Priority Checklist

CATEGORY	PURPOSE	ITEMS
Medical	Treat injuries and illness	First-aid kit, prescription meds, aspirin, splint, blood-clotting agents
Shelter/Clothing	Survive the elements and maintain body temperature	Bivvy shelter, space blanket, tent, tarp, poncho, parachute chord, waterproof shell, hat, gloves, wool socks, heat packs, sunscreen, lip protection
Fire	Signaling, comfort, and warmth	Sparking metal fire-starter tool, storm-proof matches, weather resistant lighter, petroleum jelly-soaked cotton balls or fire-starter sticks
Rest/Attitude	Preserve physical condition and mental attitude	Picture of a loved one or item of sentimental value, book, deck of cards, survival guide, foam camp pad
Water	Maintain hydration	Water bottle, purification tablets or device, water collection container
Food	Provide energy to preserve physical condition and maintain mental acuity	Trail mix, jerky, nuts, energy bars, MREs, high-calorie gel packs, fishing kit
Signaling	Aid search and rescue	ELT, PLB, or commercial tracking device; satellite phone, handheld radio, whistle, flares, strobe or laser beacon, signal mirror/reflector, bright colored fabric
Tools and Miscellaneous	General survival utility	Flashlight or headlamp, duct tape, parachute chord, small straight blade knife, multi-tool, pocket saw, compass, paper and pen for notes

(Continued from pg 10)

Protection From the Elements

Fire, clothing, and shelter are all critical protections against the elements. Fire is indispensable for signaling, protection against weather and critters, staying warm, boiling water, or melting snow. But natural fuel is not a guarantee at a forced landing site, especially in a cold weather environment. A small package of fire starter can be stored

socks and reliable footwear when you depart means you will have the right shoes on for your rescue. Gloves and a hat can be stored in your vest. Carry neoprene gloves if you are flying over water.

Shelter provides protection from the elements, protects supplies, and lengthens survival times. The ideal shelter is a lightweight emergency

rest and recover. You won't need to exert yourself much if you follow the guidelines—SAGA—and stay with the forced landing site. If for some reason travel or exertion is warranted, you will need the energy.

Training is Another Key to Survival

Survival skills are similar to piloting skills—you are only as good as your

in your vest. A small stove is even better, but will likely have to go in a survival kit.

There is an old adage among mountaineers that there is “no such thing as bad weather, only bad clothing.” Before starting your flight, ask yourself if you are dressed for the terrain and weather you are flying over. Synthetic pile, wool, and comfort are your allies. Cotton clothing is generally a liability because of its poor insulating ability when wet (it tends to trap moisture next to skin). A hat, gloves, and multiple thin layers, including a wind- and water-proof outer shell, are adaptable to most weather situations and allow you to be more productive in accomplishing survival tasks like building a shelter. For hot weather, protection from the sun is critical. Consider sun-protecting clothing, hats, sunscreen, lip protection, and potentially a tarp for shade.

Don't forget your extremities. Cold weather survival requires functioning hands and feet. Wearing proper

pocket shelter or specialized low-profile hammock tent. They are not too difficult to find. Paracord and a large sheet of waterproof material can be a fine substitute, and can also easily be stored in your survival vest. It is best to carry both options. If your large tarp or tent in the back of the plane survives the forced landing, you can use your extra waterproof sheets to collect water or keep your gear dry.

Food

Humans can survive a long time without food, but food helps us make better decisions and have more energy for other survival tasks. Packing high-calorie items such as granola and protein bars, seeds, jerky, and candy will help keep you focused and rational. This is especially important if you are unskilled at hunting, fishing, or foraging for vegetation, or have the skills but are not carrying the proper equipment. When your food is limited, be mindful of preserving your energy and limiting exertion to priority activities that have a tangible survival benefit. Don't hesitate to

training. The more recent and better your training, the more likely you will know what to do. A wide variety of wilderness survival courses, seminars, online courses, and general training are offered year-round (see Build Your Survival Skills resource list). They can be an enjoyable way to enhance your 'great outdoors' skill set.

Success Comes to the Prepared

On Tuesday, Nov. 18, 2014, the Winnipeg Free Press reported a successful search and rescue effort after a small plane crashed in northern Ontario, 560 km/348 miles north of Thunder Bay. A Hercules aircraft from 17 Wing Winnipeg spotted people walking near the crash site and dropped a message bundle that contained a radio. They determined there were no major injuries, then remained in the area until a helicopter picked up the downed crew.

“Those guys were well-prepared,” said Capt. Kevin Coulombe, commander of the Hercules that located the crash site.

There is an old adage
among mountaineers that
there is “no such thing as bad
weather, only bad clothing.”

“They had a fire going, they had food and water, they had a tent set up, and they were ready.

“They had a 406 beacon, which transmits a GPS location to a satellite. It gives a tail number and even information about who is flying the aircraft.”

Survival is an individual responsibility. Less regulation is a shift toward more individual responsibility.

Mental and physical preparation is as important in a catastrophe as having the right gear. Improving your communication improves your odds. Communicate with people at both ends of your trip so someone is expecting you, with ATC so you are on a known flight course, and with your passengers so they know where survival and rescue equipment is located and how to use it.

If you are lucky, you will never need to use your survival skills and gear. But if the time comes that you need them, you will never regret your forethought, preparation, training, and gear acquisition.

Build Your Survival Skills

A pilot who is prepared for survival has better odds. Using checklists, stocking aviation survival kits, building wilderness living skills, and conducting dry runs to see if you have the right gear are all good ideas. There is a wealth of information available, but here are a few places you can start:

Passenger Safety & Briefing Cards

- Passenger Safety Briefing Sheets: Location of survival and rescue items (fire extinguisher, communications and signaling equipment, survival kit) and how to use them. AOPA offers a customizable Passenger Briefing Card as a downloadable pdf. [www.aopa.org/-/media/Files/AOPA/Home/Online Education/passenger_safety_briefing_card.pdf](http://www.aopa.org/-/media/Files/AOPA/Home/Online%20Education/passenger_safety_briefing_card.pdf)
- The Passenger Safety Briefing (AOPA Air Safety Institute video): The critical information your passengers need to know [www.aopa.org/AOPA-Air-Safety-Institute/passengerbriefing](http://www.aopa.org/AOPA-Air-Safety-Institute/Passenger-Safety-Briefing)

- AOPA Air Safety Institute Survival Safety Spotlight: <http://www.aopa.org/Pilot-Resources/Air-Safety-Institute/Safety-Spotlights/Survival-Safety>

- Survive: Beyond the Forced Landing Safety Video: <http://www.aopa.org/AOPA-Live?watch={8841D3F4-19B9-4BA8-938F-E02B8987C3B8}>

Survival Kit Content Lists

- Equipped to Survive Foundation: Basic Two-Person Aviation Survival Kit content list <http://equipped.com/basic.htm#BasicTwoPersonKit>
- Prepared Pilot Wilderness Aviator Survival Kit Contents List: Aviation accident survival kits and supplies <http://www.preparedpilot.com/Survival-Kits/Contents.htm>
- Doug Ritter Aviator Survival Paks™ Contents: Aviation accident survival kits and supplies http://www.dougritter.com/DR-aviator_survival_pak_contents.htm
- BG Wilderness Survivor Survival Kit: Aviation accident survival kits and supplies http://www.bestglide.com/wilderness_survivor_survival_kit.html

First-aid

- Canadian Red Cross Wilderness First Aid: Basic, wilderness, and other specialized first-aid training offered year-round throughout Canada <https://apaccess.redcross.ca/coursemanager/coursesearch.aspx?lang=E>
- Red Cross Basic First Aid class <http://www.redcross.org/take-a-class>
- US Wilderness First Aid course <http://www.nols.edu/wmi/courses/wildfirstaid.shtml>

Signaling

- Products: A range of rescue devices (AOPA): PLBs and personal tracking devices <http://www.aopa.org/News-and-Video/All-News/2012/April/1/Products-A-range-of-rescue-devices>

- Equipped to Survive Foundation: Overview of rescue signaling <http://www.equipped.org/signal.htm>

Wilderness Survival Courses

- Canadian Wilderness School and Expeditions (Alberta): Courses and expeditions <http://www.cwexpeditions.net/>
- Canadian Bushcraft (Ontario): One day seminars to week-long treks <http://www.canadianbushcraft.ca/>
- Canada West Mountain School (British Columbia): Wilderness survival and wilderness first-aid <http://www.themountainschool.com>
- Wilderness Survival Schools of North America: An online directory of programs, courses, and seminars throughout Canada and the U.S. that teach wilderness survival skills http://www.hollowtop.com/Schools_North_America.htm

Water Survival/Submerged Egress

- “Survival in the Water” (2000, AOPA article): The elements of ditching in open water http://flighttraining.aopa.org/magazine/2000/June/200006_Features_Survival_In_The_Water.html
- Water Survival Training (AOPA Live video): AOPA reports on a training course for pilots on how to save themselves and their passengers <http://www.aopa.org/AOPA-Live/Safety?page=3&watch=%7BF6D14166-1E15-4C78-8D31-D355C574F607%7D>
- Underwater Escape (AOPA Live video): Bryan Webster recounts his accident and shares his insights about how to prepare if it happens to you <http://www.aopa.org/AOPA-Live/Safety?page=5&watch=%7B809D9C7A-4A16-47A7-8D75-E4BF857D216C%7D>

Winter Survival

- After the Accident, Waiting for Rescue (AOPA): Articles, videos, and news about accident survival in the winter <http://www.aopa.org/News-and-Video/All-News/2012/February/After-the-accident-Waiting-for-rescue>

- Tips on Winter Flying (AOPA): General overview and survival tips [http://www.aopa.org/Pilot-Resources/PIC-archive/Operations/Winter-Flying-\(2\)](http://www.aopa.org/Pilot-Resources/PIC-archive/Operations/Winter-Flying-(2))

Books & Articles

- 98.6 Degrees: The Art of Keeping Your Ass Alive! Cody Lundin ISBN: 1-58685-234-5, 240 pages
- Aircraft Survival Kits. Rob Hunter, SW Aviator Magazine <http://www.swaviator.com/html/issueMJ02/basics5602.html>
- Aviation Safety: Post-Impact Fires (TSB of Canada): Investigatory report and recommendations for mitigating risks associated with post-impact fire following small-aircraft accidents http://www.tsb.gc.ca/eng/rapports-reports/aviation/etudes-studies/siia0501/siia0501_sec2.asp
- Mountaineering First Aid: A Guide to Accident Response and First Aid Care, 5th Edition. Jan Carline, Ph.D., Steve MacDonald, M.P.H., Ph.D., Martha Lentz, R.N., Ph.D. ISBN: 978-0-89886-878-4, 176 pages
- Prepared for Anything. Roger Storey FAA Airman Education Programs http://www.faa.gov/pilots/training/airman_education/topics_of_interest/prepared/
- SAS Survival Handbook, Revised Edition: For Any Climate, in Any Situation. John 'Lofty' Wiseman, ISBN-13: 978-0061733192, 676 pages
- SAS Survival Guide: How to Survive in the Wild, on Land or Sea. John 'Lofty' Wiseman, ISBN-13: 978-0007320813, 384 pages
- Survival, Evasion and Recovery Multi-service tactics, techniques and procedures. US Army Field Manual <http://fas.org/irp/doddir/army/fm3-50-3.pdf>
- The Extreme Survival Almanac: Everything You Need to Know to Live Through a Shipwreck, Plane Crash, or Any Outdoor Crisis Imaginable. Reid Kincaid, ISBN-13: 978-1581602883, 480 pages
- U. S. Air Force Survival Handbook. United States Air Force ISBN: 9781602392458, 592 pages
- www.equipped.org: Equipped to Survive Foundation; reviews and information on outdoor gear and survival equipment and techniques. Web site is supported by the non-profit 501(c)(3) Equipped To Survive Foundation and edited by noted survival authority Douglas S. Ritter
- www.eri-online.com: Emergency Response International, Inc. (ERI); specializes in global survival, search and rescue (SAR), and emergency preparedness training, publications, consulting, and superior products
- www.preparedpilot.com: Aircraft survival kits and aviation emergency equipment
- www.sassurvivalguide.com: SAS Survival Guide app available for iPhone, iPad, Android Windows phone

Online Aviation Survival Vendors Resources

- www.bestglide.com: Best Glide Aviation Survival Equipment, Inc.; retailer offering aviation, wilderness, and personal survival and rescue equipment gear and kits.
- www.dougritter.com: Aviation survival information training and gear

Basic Two Person Aviation Survival Kit

<http://equipped.com/basic#BasicTwoPersonKit>

QTY	SURVIVAL EQUIPMENT OR SUPPLIES
	SIGNALING GROUP
1	Signal Mirror, 8 cm x 13 cm (3 in x 5 in)
2	Whistles
	EMERGENCY DEVICES GROUP
1	Knife—fixed blade, 10 – 15 cm (4 in – 6 in), drop point, plain edge, with sheath
1	Multi-Tool with locking blade(s) and tools
1	Knife Sharpener
1	Survival Saw
1	Compass
2	Windproof/Waterproof Matches
1	Flint-style Fire Starter
-	Tinder (qty. sufficient to start min. 6 fires, may be included with fire starter)
1	Survival Candle
1	Fishing Kit (mostly for entertainment)
1	Lithium Battery Powered LED Flashlight w/ spare batteries*
	SHELTER and PERSONAL PROTECTION GROUP
1	Ripstop Nylon Tarp, 2.4 m x 3 m (8 ft x 10 ft) or 2-person Tube Tent
2	Poly (not Mylar) Emergency Blankets or Emergency Bivvy Saks
2	Lightweight Plastic Ponchos
1	Pair of Leather Work Gloves
2	Bandanas
1	Insect Repellant*
1	Sunscreen SPF-30+*
1	Lip Balm SPF-30+*
	Optional (advisable for cold climates)
-	Chemical Hand Warmers, 12-20 hour*
-	Cold Weather Gear incl. knit caps, socks, gloves, thermal underwear, sleeping bags, etc.
	MEDICAL GROUP
1	Wilderness First Aid Kit supplemented with extra supplies, bandages, and if desired, prescription drugs*

(Continued on pg 16)

(Continued from pg 15)

	(The following quantities include those in the medical kit)
	Trauma Dressing
2	Gauze Compress
4	Elastic Bandage, 91cm/3in
1	Triangular Bandages
1	Essential Personal Medications (carry at least 1 week supply on person)*
-	
	WATER AND FOOD GROUP
2.4L (2.5Qts)	Water in sealed container(s) (7.5 l (2 gal.), or more, in arid climates) (If water in flex-paks, include at least one Canteen or Water Bag)*
-	Water Disinfectant Tablets or Water Purifier sufficient to disinfect at least 19 liters/5 gallons of water*
	Optional
-	Hard Candy, Gum, etc., as desired (not a substitute for real survival rations, but good for quick energy and a morale booster)*
-	Coffee, tea, hot chocolate, flavored/sports drink mix, bouillon cubes, etc., as desired*
	2400 Calorie Survival Rations per person*
2	
	MISCELLANEOUS / MULTI-PURPOSE GROUP
1	Toilet Paper
15 m (50 ft)	249.4 kg (550 lbs) test mil-spec Parachute Cord
15 m (50 ft)	Roll Utility Wire
3m ² (10 sq ft)	Heavy Duty Aluminum Foil
4	Zipper Lock Plastic Freezer Bags, gallon
8	Zipper Lock Plastic Freezer Bags, quart
4	Heavy Duty Garbage Bags, 114+ l (30+ gal) size
1	Metal Pot or container suitable for use over a fire
1	Duct Tape
2	Sewing Kit including needles, medium & large, and strong thread
10	Safety Pins, medium and large
1	Notebook (best if waterproof paper)
1	Pencil or Waterproof Pen
1	Survival Manual
1	Contents List
1	Container or Pack to hold kit contents (except extra water)