My technique for manually extending landing gear on a Bonanza or Baron

BY THOMAS P. TURNER

Ready to land, you put the gear handle down. But wait a minute – there's no "whir" of the gear motor, no feel of the additional drag, no indication of landing gear either "in transit" or down and locked. The gear isn't down!

You take a moment to troubleshoot – yes, you moved the correct control to command "gear down." Yes, the landing gear motor circuit breaker is pushed in. For whatever reason the landing gear did not extend. It's time to exit the traffic pattern and perform a landing gear manual extension procedure.

If you've never had the opportunity to hand-crank the landing gear of your Bonanza or Baron, find a qualified safety pilot or instructor and go practice the procedure. Manual landing gear extension is something of a rite of passage for Beech pilots. The procedure may not be easy, and you need to know what you'd be up against if you ever need to do it "for real."

No Federal Air Regulation requires that you be trained on manual landing gear extension as part of whatever Beech checkout you received. Some checkouts skip the procedure because it takes time and effort, and perhaps out of an instructor's fear of doing things wrong. If you've never hand-cranked the gear in the airplane you fly, you really need to do that – at least once.

The landing gear system

The Bonanza/Baron landing gear consists of a large gear box, mounted between the carry-through spars behind and between the front seats. An electric motor runs the system. It uses push rods to extend and retract the gear. There's a hand-crank attached to the main drive shaft, which extends from the rear of the forward spar cover, and is used to manually turn the gear box in case of gear motor failure.

A landing gear motor circuit breaker controls electrical power to the unit. This breaker is at the upper right corner of the left-sidewall circuit breaker panel in airplanes with this breaker arrangement. It is under the pilot's yoke in some models, and at the far left of the row of breakers in most other airplanes. (Check for the breaker location in the airplane you fly.) Notice there's another breaker labeled "landing gear relay." This provides power to the gear indicating system, i.e., the green lights. Make sure you properly identify the critical landing gear motor circuit breaker before running the manual gear extension checklist.

There's nothing hydraulic about the Bonanza/Baron landing gear. That makes it generally less likely to fail than most general aviation landing gear systems. The broken seals and leaked fluid that lead to so many light plane gear failures simply can't happen in these Beechcrafts. Without hydraulic fluid, however, there's no reserve of pressure to help "blow down" the gear in the event of a motor failure, and the Bonanza/Baron gear will not free-fall down from the force of gravity or a little high-gee maneuvering like most hydraulic systems will. In short, your landing gear isn't as likely to fail to extend, but if it does, you'll have to do all the work of getting

the gear down yourself.

When manual gear extension will work

The manual landing gear extension procedure will not always force down a broken gear system. If the gear "hangs up" because of a failed or restricted push rod, if a foreign object jams the gear system, if only one or two landing gear legs extend, or if the "sector gear" inside the landing gear box breaks, the manual landing gear procedure will not improve your situation. In these cases, you're usually stuck with whatever landing gear extension you've got.

If the reason for landing gear failure is electrical (total electric system failure, or failure of part or all of the landing gear extension motor), performing the landing gear manual extension checklist will allow you to make a normal landing.

Bear in mind that running the checklist may take a lot of time and effort. The newer your airplane, the harder it is to crank down the gear. There are several factors that affect this, including seat height and the angle at which you sit relative to the hand-crank. Regardless, manual gear extension isn't something you can do while continuing an approach, or while in the airport traffic pattern. It simply takes too much time and work to do while simultaneously preparing for landing.

If you put the landing gear handle "down" and nothing happens, then you should verify you moved the correct control in the proper direction; check to see that the circuit breaker has not popped (if it has, abort your approach, let the breaker cool at least a minute and then reset the breaker and try again); and if you determine it's time to do a manual landing gear extension, get away from the airport and run the checklist.

In visual conditions, climb to at least 1,000 feet above terrain and obstacles (even higher, if weather, airplane performance and airspace permit). If IFR, miss the approach and ask for a vector or a holding pattern in which to extend the gear. If radar service is available, ask the controllers to monitor your heading and altitude, and let you know if you make any deviations. It can't hurt to have an extra set of eyes watching out for you during this busy time. Once established on heading and altitude, engage the autopilot – if you have one, and if you have power to run it – or trim for level flight, then pull out the checklist.

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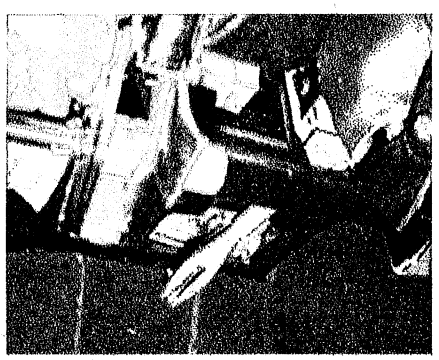
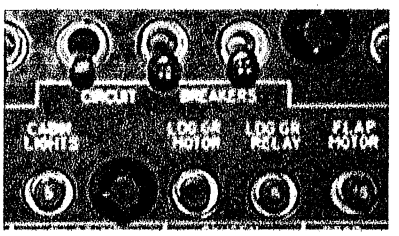


The manual landing gear extension hand-crank as seen from the pilot's seat.



The landing gear motor circuit breaker, beneath the pilot's yoke in a B55 Baron. Don't confuse it with the nearby landing gear relay breaker.

Read a step, do a step

There's a possibility of injury if you don't do the landing gear manual extension correctly. If it is incompletely performed, the gear will likely fold on touchdown or during your landing roll. So it's a good idea to pull out this emergency checklist and actually run it one step at a time, reading a step, doing a step, verifying that each one has been correctly done. If you have a copilot or passenger on board, have him or her help by reading the checklist steps to you.

Once you're trimmed for level flight, slow the plane down. Flying slowly, you'll stay closer to your intended destination airport, and be less likely to get lost or to approach worse weather or higher terrain. At a slow airspeed, the airplane will take more time to accelerate to a dangerous speed or attitude if you get distracted. Flying slowly will make manual extension much easier; the faster you're flying, the harder it is to force the gear out against the wind. I recommend slowing to whatever you use as a normal downwind leg or final approach course inbound speed – you'll know about what power setting and attitude "feels right," and won't have to deal with an unfamiliar configuration while extending the gear at the same time.

The Pilot's Operating Handbook (POH) says that manual gear extension will take about 50 turns of the hand crank. Consider this to be approximate. Your only indication that the gear is all the way down and firmly locked is when you reach full travel of the sector gear, and the hand-crank simply can't be turned any more. This is important for reasons you'll learn in a moment. The "short version" is that if you don't get the hand-crank to the full extent of its travel, then the landing gear will most likely collapse on the runway.

First step

The first step on the checklist is to pull the landing gear motor circuit breaker. This removes electrical power from the landing gear motor. If the reason for the failure to extend was that the motor had stopped on a "flat spot," or burned-out brush, hand-cranking will put it in contact with a "good" brush, and if power is applied, the gear motor will take off.

The manual gear crank is directly connected to the gear motor shaft. If suddenly the gear begins to run, the hand-crank will spin wildly, and it's likely your hand would be broken or crushed in the narrow space between the hand-crank and the floor. You avoid this hazard by removing power to the motor before you begin cranking.

If you're sitting in the pilot's seat and look back toward the manual hand crank, you'll see a copy of the emergency extension checklist on a placard glued to the floor. Look closely and you'll see that the step commanding you to pull the circuit breaker is not printed on this placard. Ignore the placard and use your POH checklist.

If the airplane is without electrical power, you know why you're cranking the gear. If

power is available, it may be that a single "flat spot" in the motor is making you do all this work. You might try the "advanced technique" of pulling the circuit breaker, turning the hand-crank a turn or so, stowing the manual gear handle and then resetting the breaker. That might make the gear run the rest of the way down under power, saving you a lot of effort. If this works, have the gear motor checked before your next flight.

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Second step

The second step of the checklist says: "landing gear switch handle – DOWN." It's referring to the normal control you use to extend and retract the gear day-to-day. The position of this handle has no effect on manual landing gear extension. With the handle "down," however, the relays that provide gear position indication ("in transit," "down and locked") are armed, so you'll have some verification of your progress during this emergency procedure. With that step done, now it's time to start cranking.

Depending on the age of the airplane, there may or may not be a cover over the manual gear extension hand-crank. Some have a fabric or leather "boot" held with a snap. Later models have a plastic cover held against the spar cover with Velcro. With the hand-crank exposed, you'll see it folded over against the shaft. This position disengages the crank from the gear shaft so that the crank does not spin wildly around any time the gear motor runs. Grasp the crank and snap it into the "engaged" position.

From a "gear up" position, the hand crank will only turn in one direction: counterclockwise. Remember what this feels like when you begin cranking, because it's easy to reverse direction and accidentally start cranking the gear back up. In fact, there's a note in the POH advising that you not attempt to manually retract the landing gear. It may be there is more stress placed on the manual gear handle when the gear is brought up. Regardless, it makes sense to get the gear DOWN and keep it down until the airplane is up on jacks for repair, if you've had to manually extend it for real.

As stated, it will take approximately 50 turns of the crank to get the gear down. The further out the gear extends, the harder it'll be to crank against the wind. Break the procedure into sets, and you'll find it easier to complete. Turn the crank counterclockwise 15 turns. The first 15 turns will be pretty easy. If electrical power is available and your airplane is so equipped, you'll see the red landing gear "in transit" light illuminate soon after you begin cranking. You'll also hear and feel the familiar effects of gear doors opening and draggy gear legs hitting the slipstream, albeit in much slower motion than normal.

After your first 15 turns, sit up, look around, shake out the muscles in your arm, then do another 15 turns. It'll be getting a bit harder now. One smart Bonanza pilot suggests using a towel wrapped around the hand-crank for additional leverage, and to avoid the inevitable skinned knuckles caused from turning the crank in such small confines. After this second 15 turns, sit up, look around and shake it out again.

Now turn the hand-crank counterclockwise 10 turns. It's much stiffer at this point. Sit up, look around, shake it out, and turn the crank the final 10 turns or so, until it won't turn any more.

Verifying "down and locked"

If power is available, about the time you finish this last and sometimes painful turn of the

crank, you'll see your green landing gear "down and locked" indication. Do not stop yet! The microswitches that provide the green-light indication engage just as the landing gear is approaching down-and-locked. In normal operation, the gear is traveling so fast that if the light(s) is/are on, you can be assured that the momentum of the gear has snapped it into the downlocks.

If you're providing the gear's motive power, however, it will be extending much more slowly, and the green-light switches activate prior to final gear lock. In fact, you'll see the green light(s) illuminate when you still have about one-half to one full turn of the hand-crank remaining. What's this mean? If you're manually extending the landing gear, a "three green" landing gear indication does not mean that the gear is down and locked – just that it's almost there. If you stop cranking as soon as you see green lights, the landing gear will almost certainly collapse when you roll onto the pavement. Your only indication that the gear is truly locked is when the manual gear hand-crank will not turn any more – the sector gear has reached its extreme end of travel.

That's why I recommend this last set to the hand-cranking regimen. After you're sure you've reached the end of travel, sit up, look around, take a longer break, and then try one last time to turn the crank. In my experience teaching hundreds of Bonanza and Baron pilots this procedure, the majority could get another quarter to half a turn after taking a longer break at the end of cranking – the difference between a successful landing and a gear failure on the runway.

The POH also recommends checking the gear position with the gear warning horn and, if equipped, the gear extended annunciator light. The procedure is to pull the throttle back to below the position that nets about 12 inches of manifold pressure at sea level. If the gear is not locked down, the horn and light are supposed to warn you. Trouble is, these indicators are wired through the same microswitches that give you the green lights and, therefore, tell you nothing the green lights have not already. In other words, since the green lights don't tell the whole story during manual landing gear extension, neither does the warning horn. Go ahead and check if you like, but in my opinion this step is a waste of time.

Finally, stow the gear crank in the disengaged position. This step is here mainly for the protection of whoever will be working on your airplane after you land. If you've accomplished a real-world manual gear extension, leave the gear down, and don't touch anything else landing gear-related until after you've handed the plane over to a mechanic.

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Energy management

Manual gear extension is a very distracting procedure. I've seen numerous pilots pulling their airplane into a sloppy chandelle while reaching back, head down and cranking. Keep your primary responsibility – flying the airplane – in mind at all times. If you sense you're off heading or altitude, or just feel too many seconds have gone by since you checked, stop what you're doing and fly the airplane. Here's a good place to have help, in the form of a passenger watching your attitude, or an autopilot flying (with your active monitoring, especially of position relative to terrain) for you.

As you crank the gear into the wind, the additional drag will begin to slow you down. Since most airplanes will change pitch to maintain a trimmed airspeed, expect the airplane to

lose altitude during the gear extension procedure – unless, of course, you do something to compensate for the drag. I like to maintain airspeed and altitude by increasing power slightly at the end of each set of hand-crank turns.

Think about it – putting down the gear gives you about 500 feet-per-minute descent rate if done from level flight at a constant power setting. Each inch of manifold pressure, by itself, will change your vertical speed by about 125 feet per minute. Therefore, during the landing gear manual extension, you'll need to gradually add about four inches of manifold pressure. That's easy: After each set of cranking turns, when you sit up to look around, add about an inch of power. You'll find it easy to maintain altitude and airspeed with this technique.

I've spoken with a highly experienced Bonanza instructor who advocates setting power and trimming for a 500 feet-per-minute climb at the beginning of the procedure. As the gear cranks down, the airplane will gradually level off. My only objections to this technique are that it may get the unwary pilot into clouds or controlled airspace when trying to do this under visual rules, and depending on density altitude, sufficient power might not be available to keep the airplane from getting dangerously slow or entering an inadvertent descent.

If you've got an autopilot, and electricity to run it, use it – but still add power incrementally. An autopilot's altitude hold mode will command a pitch-up with the addition of drag and loss of airspeed – I've tried it. A Bonanza can actually stall while on the autopilot if power is not added during manual gear extension.

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REVIEW OF THE FULL TECHNIQUE

This is the full technique I teach for manually extending a Bonanza or Baron's landing gear. Remember that this technique is but one way to successfully accomplish the procedure (the easiest and safest one, in my opinion), and the manufacturer's recommendations, of course, take precedence.

1. Determine the need for manual gear extension.
2. Abandon approach and climb to a safe altitude and area.
3. Engage the autopilot, if available.
4. Review the POH checklist before beginning the procedure.
5. Follow the checklist. When reaching the step that calls for cranking the gear, proceed as follows:

Crank	Then	Add	And
15 turns	Scan for traffic	1 inch MP	Take a short rest and look around
15 turns	Scan for traffic	1 inch MP	Take a rest and look around
10 turns	Scan for traffic	1 inch MP	Take a rest

			and look around
10 turns as far as it will go	Scan for traffic	1 inch MP	Take a LONG rest and look around

6. Complete the checklist. Stow the hand-crank, but otherwise do nothing to the landing gear system.
7. If this was a practice manual gear extension and you wish to retract the gear electrically, follow the POH landing gear retraction after practicing manual extension checklist.
8. Land. If this was an actual (not practice) manual gear extension, arrange for a mechanic to inspect and repair as necessary the landing gear system.

The Raytheon/Beech Bonanza and Baron landing gear system is probably the most tested retractable gear design in history, used in tens of thousands of Bonanzas, Barons, T-34 Mentors and Dukes. Fully electromechanical, it is not as likely to suffer failure as some hydraulic models.

If the gear system does fail, however, it will take time and (in many airplanes) considerable physical effort to manually extend the landing gear. This technique, or something similar of your own making, will help you to properly and safely lower the landing gear in an emergency.

If you've never done this rite of passage in the airplane you fly, it's a good idea to find a qualified safety pilot or instructor and perform a practice manual landing gear extension.

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