Flying the DC-3

The only sure way to increase your enjoyment of flying the DC-3 is to become more proficient. And that's just what will happen if you work your way through the following sections.

Nine sections cover the pre-takeoff to landing procedures as well as slow flight and go-arounds. You'll learn and use those procedures in a thirty-minute flight from Newport State, R.I. to Provincetown, Mass.

You'll love the 15-minute flight chosen to practice go around and short-field landing techniques and full details are in the Go-Around section. Fly from Quonset Airport, in North Kingstown, Rhode Island to Elizabeth Field on Fishers Island, N.Y. If your approach to Elizabeth Field's 1790 ft Runway 25 isn't perfect, you'll have to exercise a go-around.

We've chosen another airport for the short-field takeoff. It's Myricks Airport near Berkley, Mass., with a 2150 ft. turf runway. Should be a piece of cake with the right technique. See the Takeoff section for details.

The Sperry Autopilot, Fun Flights, and Checklists wrap up this chapter.

The DC-3, like all aircraft, should be "flown by the numbers." To get from one airport to another the pilot must takeoff at the proper speed, climb and descend at established rates and airspeeds, maintain desired headings and altitudes, navigate from one airport to another, perhaps perform an instrument approach to an airport, and land in a variety of wind and runway-surface conditions.

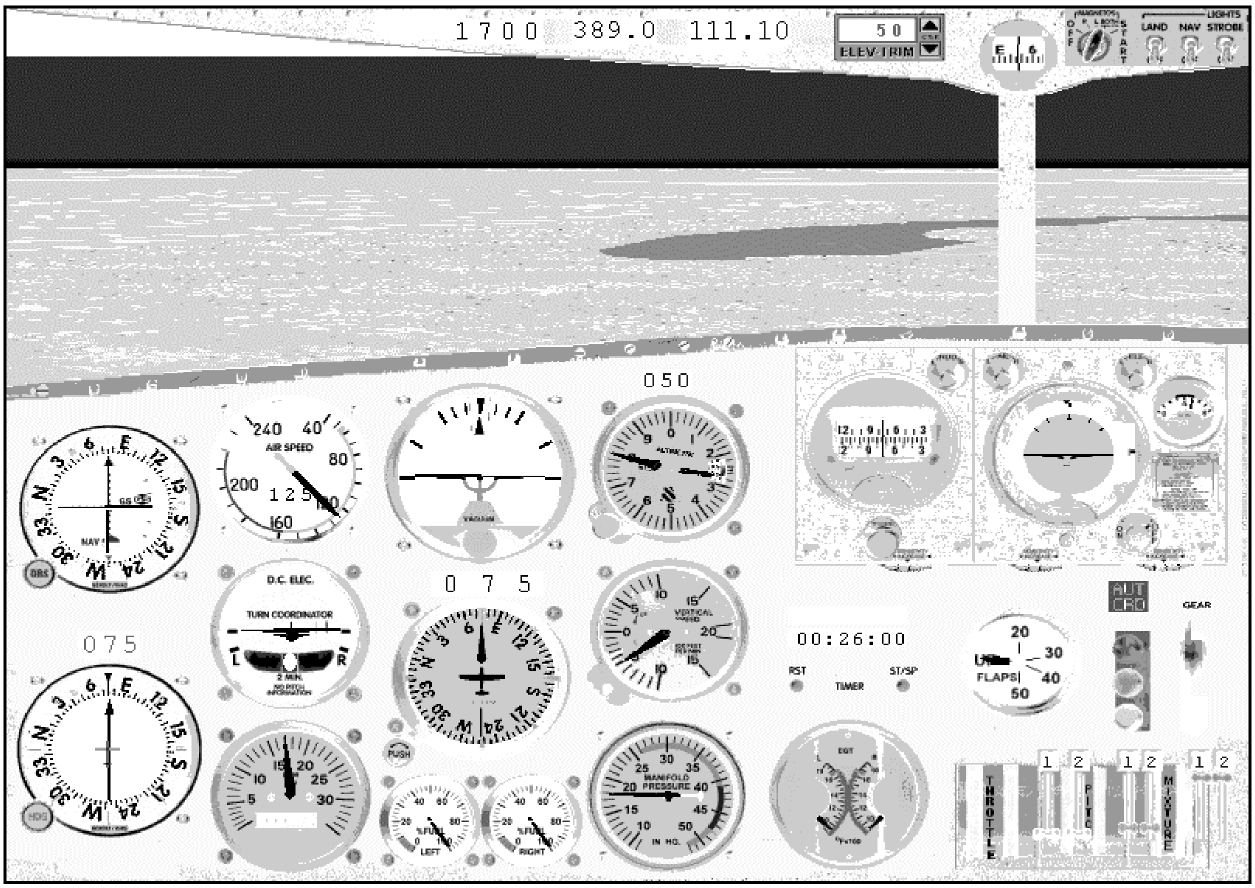
A typical flight has seven segments:

- Pre-Takeoff
- Takeoff.
- Climb.
- Cruise
- Descent.
- Approach.
- Landing.

On occasion you'll also encounter two other flight situations:

- The Go Around
- Slow flight.

While everyone has their favorite DC-3 aircraft and panel, I recommend that you begin with the "Company DC-3" and panel found in the Downloads section. Large-size instruments are on the panel so that you can quickly discern the effects of the flight and power controls. For best quality, video card and monitor permitting, set your Flight Simulator resolution to 1024 x 768 pixels or higher.



The DC-3 Panel. – Note that all panel pictures are reversed in color to save toner or ink.

Four of the gauges on this panel may be unfamiliar.

Radio Magnetic Indicator

RMI, Radio Magnetic Indicator

The gauge on the lower left of the panel is a single-needle Radio Magnetic Indicator, the RMI. This gauge is used for ADF navigation. It derives its name from the fact that it indicates both the magnetic heading of the aircraft and the magnetic bearing to a station.

Its compass card rotates with the directional gyro and so it accurately indicates the heading of the aircraft even when in turns. The RMI needle always points to the low frequency beacon tuned in by the ADF receiver. The aircraft's nose is straight up on all ADF gauges.

The RMI greatly simplifies ADF navigation since the needle indicates the magnetic bearing to the station, and hence the pilot need only turn the aircraft that heading to home to the beacon--not always, though. Go to the Navigation Tutorial, to learn about that plus a lot of other really neat stuff that you can do when flying the ADF.

This ADF indicator shows an aircraft on a 345° heading with a 060° magnetic bearing to the beacon. This particular RMI gauge also digitally displays the bearing to the beacon, which further simplifies navigation. When the ADF receiver is off or the beacon is out of range, three dots appear in the digital window and the indicator's arrow points directly to the right.

Digital Elevator Trim

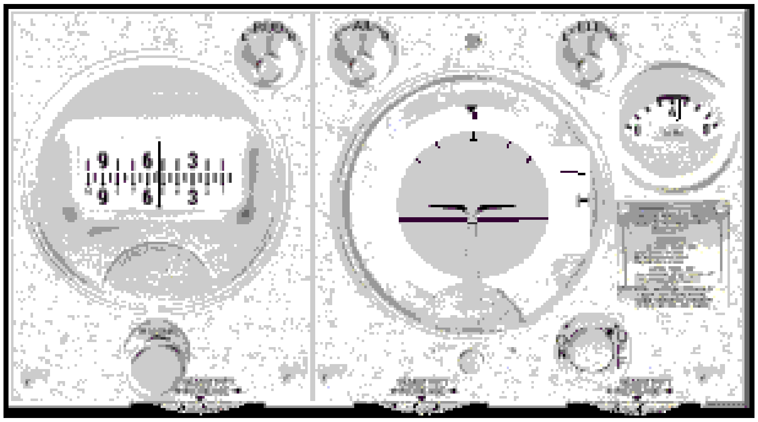
Digital Elevator Trim

The Digital Elevator Trim is on the overhead panel. Naturally, this instrument was not installed on DC-3s in the late 1940s, but it greatly simplifies trimming our virtual aircraft. The DC-3's 7 ½ inch diameter trim wheel is mounted on the left end of the throttle quadrant where the pilot can easily rotate it to take the pressure off the yoke to trim the aircraft.

Since most flight-sim setups don't have a 7 ½ inch trim wheel, the digital elevator trim is a reasonable addition to the panel. Its beauty is that the trim numbers are repeatable. Set the trim to 58 for takeoff and climb and the aircraft's performance consistently remains the same.

The Digital Elevator Trim can be set from -511 to +511.

Sperry Autopilot



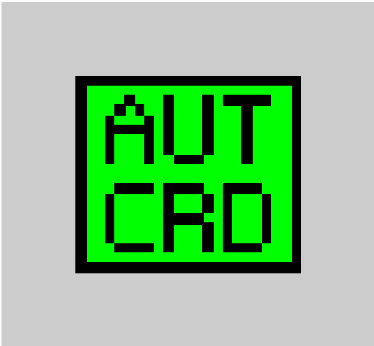
Sperry Mark III Autopilot

A third "gauge" that may be unfamiliar is the Sperry "Gyropilot." The Gyropilot was the earliest commercial autopilot and considerably relieved the pilot's task of maintaining heading and altitude, although acceptance by early airline pilots was slow.

The Sperry has fewer functions than its more-modern counterparts. For example, it will not couple to the Instrument Landing System, the ILS. But with it, a pilot can very acceptably maintain the localizer heading and glide-slope rate of descent. It's kinda fun having some control over that. Makes you feel more like the pilot.

A later section describes its setup and operation.

Auto-Coordination On-Off



Now here's a switch that definitely wasn't on the original DC-3.

The Sperry Autopilot, unlike modern autopilots, controls the aircraft heading with the rudder, not the ailerons. The Sperry Autopilot will not function properly unless the auto-coordination of the rudder and ailerons is turned OFF.

With Chuck Dome's handy auto-coordination switch the pilot can toggle from ON to OFF with a mouse-click. Just click on the face of the indicator to toggle back and forth. The switch should illuminate when Auto-Coordination is enabled.

NOTE: Although the auto-coordination switch toggles this function on and off, it isn't smart enough to know the actual status of the auto-coordination. Sometimes it gets confused and shows ON when the auto-coordination is actually OFF. The way to be certain is to go to the Flight Sim Tab "Aircraft" then "Aircraft Settings" and check the Auto-coordination box there to match the status of the switch. In flight, if the wings on the T&B gauge don't flick each time you click the Sperry Rudder Knob, the auto-coordination is ON regardless of what the light says. This is a very important pre-flight check.

Digital Timer

Digital Timer.

This panel has a digital timer which began life as Christian Koegler's digital chronometer-timer. I repainted it to remove the un-needed chronometer functions.

Use it to time your flights and critical legs of instrument approaches, and as a reminder of when to begin your descent.

It displays hours, minutes, and seconds. Reset the timer with the RST button and start and stop with the ST/SP button.

Once you begin using this instrument, you'll mount it on every panel, it's that useful. Since you have no copilot, this modern nicety can reduce your workload and eliminate much mental arithmetic.

Digital Readouts

You'll notice the several digital displays on the panel. These were included to improve the resolution of the analog gauges, since it's impractical to show gauges full size on flight-simulator panels because of monitor-size limitations.

A standard flight-gauge is 3.5" in diameter. Not many gauges would fit on a screen if they were displayed full size, so enhancing the resolution by adding digital displays is a reasonable compromise. The gauges are already quite large.

The following instruments digitally display their readings:

- The Radio Magnetic Indicator, RMI, magnetic bearing to the station.
- The Directional Gyro, DG, aircraft's magnetic heading.
- The Airspeed Indicator.
- The Vertical Speed Indicator. This display is located above the altimeter and reads in tens of feet, hence 060 is 600 fpm.
    - If the digits are yellow, the aircraft is descending.
    - If the digits are blue, the aircraft is climbing.
    - If the display shows a yellow 000, the aircraft is descending, but less than ten feet per minute.
    - If the display shows a blue 000, the aircraft is climbing, but less than ten feet per minute.
    - You'll find this digital VSI very valuable whether flying with or without the autopilot.
- Lastly, there is a second tachometer, with digital readout, on the overhead panel. More on the need for this later.

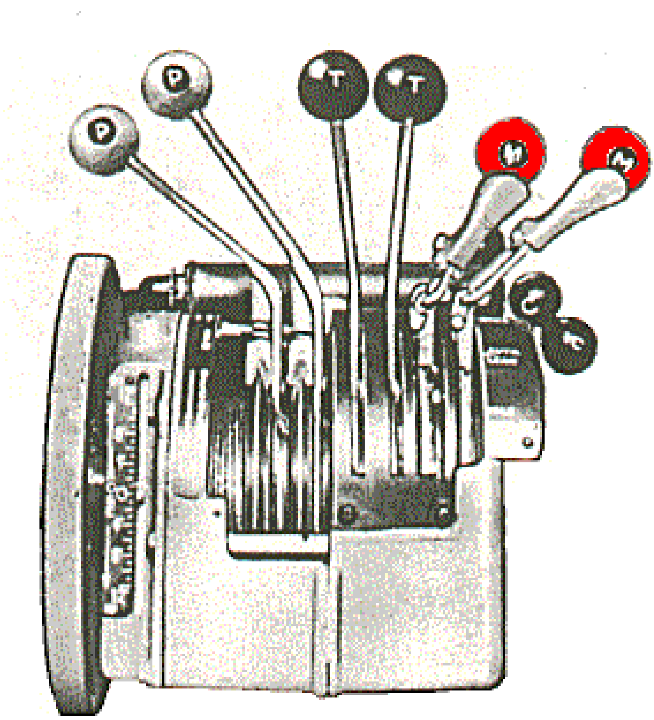
A Word about the Radios

Two radios, more of Chuck Dome's creativity, are mounted on the overhead panel. The ADF is to the left and the Nav receiver is to the right. Simply click on the digits to change frequencies. Click to the left of the first digit of either radio to activate the ident. A small white square will appear and the tonal ident will be heard shortly afterward. Disable the ident by clicking on the white square.

Flying Aircraft with Constant Speed Propellers

Too many flight-simmers miss the enjoyment of properly flying aircraft equipped with constant speed propellers. Constant speed props have been on airliners since the DC-3 and no longer is an aircraft "stuck in 2nd gear--it can move into "first gear" to climb or into "3rd gear" for best cruise.

The constant speed prop adds a propeller control to the power quadrant and a manifold-pressure gauge to the instrument panel.



DC-3 Throttle Quadrant.

The drawing to the left is a typical DC-3 throttle quadrant. The engine-controls, from left to right, are the Propeller controls--white, the Throttles--black, and the Mixture controls--red. The robust elevator-trim wheel is to the far left.

The Propeller control sets the RPMs, the Throttle controls the engine power, and the Mixture control sets the ratio of fuel-to-air for the engines.

Mastery of these controls is critical, not only to obtain the best engine performance and propeller efficiency, but to prevent their misapplication, which in the worst case could damage the engines badly enough to require an unscheduled landing.

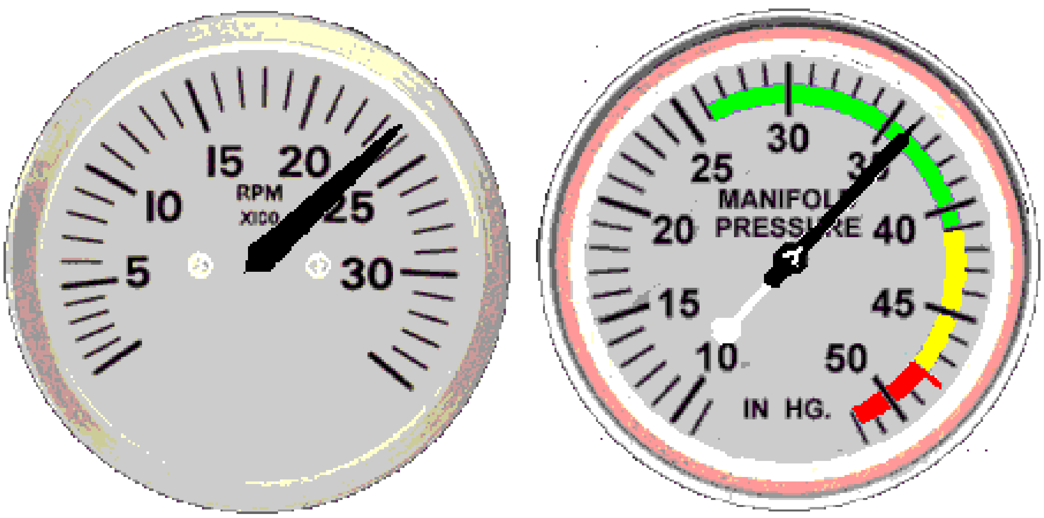
The Mixture Control varies the ratio of the fuel-to-air supplied to the engines. At sea level, where the air is heavier, more fuel, i.e., a richer mixture, may be fed to the engines. At higher altitudes, with thinner air, the amount of fuel delivered must be lowered, or "leaned out."

The fuel-to-air mixture in a DC-3 is controlled automatically and only one of three mixture-control positions need be selected: Maximum Rich, Auto Rich, and Auto Lean.

The propeller control sets the RPMs of the engine, not by varying the amount of fuel fed to the engine, but by varying the load on the engine. The more load put on an engine, it slows down, the less load, the RPMs increase. Pretty brutal, but that's the way it works. The prop control changes the load by changing the pitch of the propellor. We set the prop control by monitoring the tachometer. A governor on the propeller hub maintains the RPMs to the value set by the pilot.

In FS-98 and FS-2000, Ctrl-F1 and Ctrl-F4 are full-low and full-high RPM. Ctrl-F2 and Ctrl-F3 lower and raise the RPMs in increments.

Since we set the prop control with the tachometer, we need another indicator to set the throttle. That's the manifold pressure gauge, which monitors the pressure in the engine's intake manifold. Manifold pressure can't rise above approximately 30 in., atmospheric pressure, unless the engine is supercharged.



DC-3 Climb power settings: 2350 RPM, left, and 36 in. Manifold Pressure, right.

Although the prop control sets the RPMs, it also affects the manifold pressure. As RPMs are lowered, MP increases. Try it yourself. Put your aircraft in the air at cruise power, then reduce the RPMs with the prop control and watch the MP gauge climb. This interaction of RPMs and MP creates a potential hazard.

The combination of low RPMs and high MP heavily stresses an engine--sometimes to the extent of engine failure. So the pilot must follow the correct sequence of prop-throttle adjustments to avoid the danger zone of low RPM and high MP.

Understand that advancing the throttle increases the manifold pressure. Advancing the prop control towards "High RPM" lowers the MP because, like shifting to low gear in a car, this reduces the load on the engine. Here's the prop-throttle sequence rule:

Always adjust the control first that reduces manifold pressure.

When you need more engine power, i.e., for take-off, climbing from level flight, increasing cruise speed, or adding power when gear and flaps are lowered, always increase the RPMs first, the prop control (lowers the MP), then increase the throttle (increases the MP).

When reducing power to descend, or reducing from take-off power to climb power, or reducing to slow flight, always reduce the throttle first (lowers the MP) then reduce the RPMs (increases the MP). A second throttle adjustment is almost always necessary on power reductions to finalize the desired MP.

When climbing to cruise altitude, the manifold pressure decreases with altitude (air gets thinner) so increase the throttle as needed. The reverse is true on descending ... monitor the MP gauge, and adjust the throttle as necessary!

On final approach, or coming down the glide slope, advance the prop control to full RPM. Then, if a go-around is necessary, you only need to advance the throttle for full power. Adjust rate of descent with the throttle.

At low engine speeds, engine manufacturers recommend that RPMs (in hundreds) and MP be close to each other, i.e., for DC-3 descend, 1700 RPM and 18 in. MP.

Here are typical numbers from the 1953 Piedmont DC-3 flight manual:

DC-3 Aircraft Power Settings Card.

Take-off	**2700 RPM**	**48 in. MP**
Climb	**2350 RPM**	**36 in. MP**
Cruise	**2050 RPM**	**30 in. MP**
Descend	**1700 RPM**	**18 in. MP**

Remember that changing from take-off power to climb power is a reduction in power--throttle first.

Also note the manifold pressure at takeoff, 48 in. and climb, 36 in. ... both a clear indication that the DC-3 engines are supercharged since these numbers are above standard atmospheric pressure of about 30 in.

Create a similar Power-Setting Card for every aircraft that you fly, and stick to the numbers.

Now you can enjoy the feel *and sound* of properly flying propliners.

Microsoft's Hidden RPM Software Bug

Microsoft generously built a bug into their FS-98 software, showing up as an occasional inaccurate RPM gauge reading. This has an enormous impact on the performance of the aircraft since the propeller controls are set by the RPM readings. While the analog RPM gauge is in error with a false-low reading, the digital RPM gauge on the overhead panel always appears to read correctly.

When you begin your takeoff roll at full throttle, both RPM gauges should read 2700 RPM. If the analog gauge reads low, you can do one of two things:

- Ignore the analog gauge readings and rely on the digital gauge readings for the propeller settings.

- Abort the takeoff, reduce the throttle setting to minimum, then press "Shift-3" twice. This will momentarily activate the minicontrols, but should fix the erroneous RPM gauge readings.

A final note before moving to the actual DC-3 flights. Although the DC-3 tops my list of favorite aircraft, and I have put a lot of study into them, I have never piloted one. I've been in them, both on the ground, including the cockpit, and as a passenger in the air. If someone spots some errors or wrong methods/procedures in the flight sections, please e-mail me with the correct info, plus the basis of your corrected information.

Thank you very much.

Pre-Takeoff

Pilots, Start your engines!

Not so fast! We don't just start the engines, taxi out, and take off.

There are a number of tasks to attend to before lifting your DC-3 off the ground. The outcome of skipping the pre-flight tasks varies from a sloppy flight to a full-blown disaster.

Flying beats book-learning.

An enjoyable way to increase your flight proficiency is with a simple flight where you can concentrate on the various flight segments. A thirty-minute VFR flight from Newport State, R.I. to Provincetown, Mass., on the tip of Cape Cod, will be perfect.

There are two types of flights, VFR and IFR. As mentioned, this flight will be VFR. If you are unfamiliar with these flight types, go to the Navigation Tutorial, Basics, http://www.navfltsm.addr.com/basic-nav-general.htm for an explanation. VFR and IFR flight criteria are critically important. They establish the rules for your flight.

An important pre-flight task is to understand the flight ahead of you.

You will take off from Runway 4, Newport State, airport ID=UUU, (KUUU for FS2000 and FS2002) and climb to 5500 ft. Turn slightly right after departure and track to the Plymouth NDB at 065°, the magnetic bearing shown by the RMI. Maintain 065° until you intercept the localizer to Provincetown's Runway 7. On intercepting the localizer, turn right to 075° and track the localizer inbound to Provincetown, PVC (KPVC for FS2000 and FS2002).

The localizer is a component of the Instrument Landing System, ILS. Go to this section of the Navigation Tutorial, ILS, http://www.navfltsm.addr.com/ils.htm for more information.

If you have FSNavigator, plot the course so that you will have a graphical image of the flight. Go to the Downloads page, to “Flight Plans, Familiarization flights” and download 1200.zip for the FSNavigator flight plan. You will use 1200-PVC.fsn for this first flight.

Pre-Takeoff

Use a checklist similar to this before every flight.

- Review flight plan.
- Set the brakes.
- Check that the flaps are fully up. Flaps are not used for takeoff unless the field-length is less than 2500 ft, or on a soft field, or there is an obstruction more than 40 ft high to clear within 3000 ft of start of takeoff.
- Check the Directional Gyro reading against the compass reading.
- Check that the altimeter reads the field elevation, in this case 172 feet.
- Verify that the autopilot switch is in the OFF position.
- Turn the auto-coordination ON unless rudder pedals are installed.
- Go to the Flight Sim Tab "Aircraft" then "Aircraft Settings" and verify that the Auto-coordination box is checked if the auto-coordination light is ON. If they don't match, light ON-box checked, the auto-coordinator switch will read backwards.
- Set the elevator trim to 58.
- Tune the Nav receivers to the frequencies of the first Navaids and adjust the VOR OBS to the correct radial. For this flight, the numbers are:
    - ADF to 257 KHz., Plymouth NDB, Ident FFF.
    - Nav receiver to 111.10 MHz., Ident I-VQO.
    - For this flight, the Nav receiver is tuned to Provincetown's Localizer, so no radial is required to be set in. However, set the OBS to 075° as a reminder of the runway heading.
- Push the mixture control to full rich, Ctrl-Shift-F4.
- Push the propeller controls to the high position, Ctrl-F4.

The Engine Run-Up

Those who have flown on propeller airliners are familiar with the engine run-up. It derives its name from the pilot running the engines up for tests before takeoff. In the old days the pilot did the run-up tests at a pull-off area just before entering the runway. Today, it is usually done at the terminal before taxiing to the runway.

The pilot performs several important checks during the run-up, and any out-of-spec response can necessitate a return to the ramp in search of a mechanic, or worse, outright cancellation of the flight.

Mag Check

The first check is of the magneto ignition system. An aircraft's ignition system differs from that of an automobile in that a magneto generates the high voltage for the spark plugs. Magnetos are notoriously unreliable and hence all piston-engine aircraft have a dual ignition system, with two completely separate systems for reliability.

Here is the procedure to check each magneto system. Note that the DC-3 Airways aircraft has only one Mag switch, located on the overhead panel. Of course, a DC-3 with two engines requires two Mag switches, one for the left engine and one for the right engine. So this Mag-testing routine is only for one engine. If your aircraft has two Mag switches, perform the run-up tests for each engine separately. The engine not being tested should be at 1000 RPM.

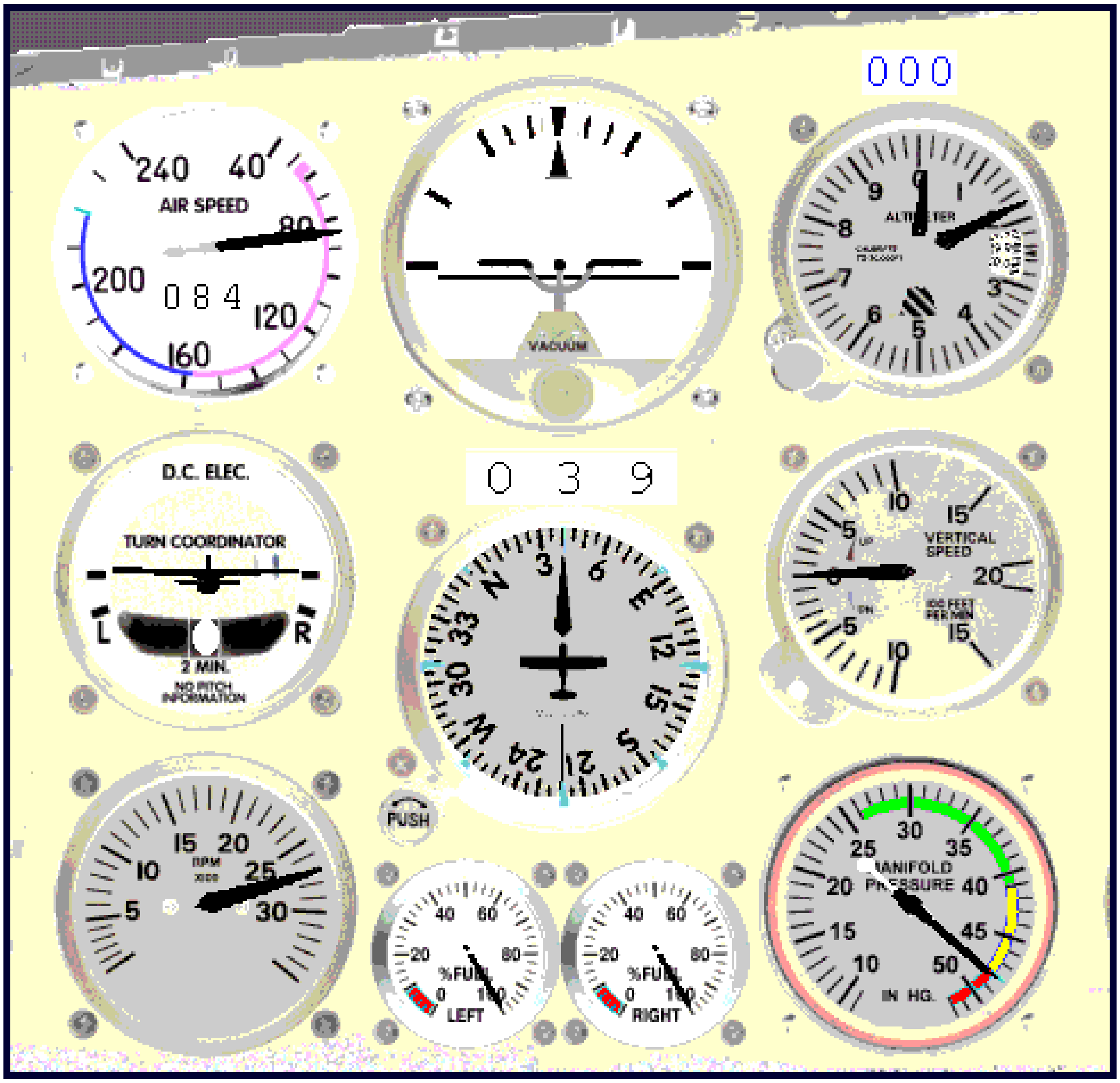
- Set brakes, Ctrl-Period--Very Important!
- Magneto switch in "Both"position.
- Propellers in the High position--full forward or Ctrl-F4.
- Smoothly advance the throttle to 2350 RPM.
- Switch the Mag switch to "Left" and note the drop in RPM
- Return the Mag switch to "Both."
- Switch the Mag switch to "Right" and note the drop in RPM.
- Return the Mag switch to "Both."
- The maximum allowable Left or Right drop is 65 RPM; 25 RPM is the normal drop.
- The allowable **difference** in RPM drop is 40 RPM. So if the Left Mag drops 60 RPM ... in spec, and the Right Mag drops 15 RPM ... also in spec, an out-of spec condition exists because the **difference** between the RPM drop for the two mags is 45 RPM, beyond the allowed 40 RPM spec. Pass the bad news back to the passengers and return to the ramp.
- Note, these are the settings for a real DC-3. You will have much greater RPM drops with FS-98 or FS-2000 DC-3s.

Propeller Check

If the Mags check OK, the prop check is next. Again, only a single check is performed since the DC-3 Airways aircraft has only a single MP gauge and a single tach. If your aircraft has dual tachs and dual manifold pressure gauges, then check both props.

- Magneto switches in the "Both" position.
- Propellers in the High position--full forward or Ctrl-F4.
- Using the throttle, set the left engine to 1700 RPM. The right engine should be at 1000 RPM.
- Smoothly move the left-engine prop control to Low RPM, Ctrl-F2.
- Note that the RPMs decrease to 1200 RPM or below.
- Smoothly return prop control to High RPM, Ctrl-F3, back to 1700 RPM.
- Decrease left throttle to 1000 RPM and repeat the prop check for the right engine.
- Again, you may not meet these real-life numbers with FS-98 or FS-2000 DC-3s.

Takeoff



Takeoff: 2700 RPM, 48 in. M.P. Lift off at 84 knots.

The familiarization flight is from Newport State, Rhode Island, to Provincetown, Cape Cod, Mass. Besides brushing up on the flying skills, it's a great opportunity to learn proper throttle and propeller-control management. The flight is VFR, brief, busy, and can be flown often without boredom. It also provides a quick introduction to ADF navigation.

Before you take the flight read through all sections.

Departure will be from Newport's Runway 4. Recall the flight plan:

Track from Newport, heading 065°, to FFF NDB. Intercept Provincetown Runway 7 localizer, 075° heading, landing will be on Runway 7; field elevation: 8 feet. Total distance: 58 NM., 30 min. flying time.

Cruise altitude: 5500 feet--Memory aid: "Easterners are Odd ." For VFR, headings of 0° to 179° fly at odd-numbered thousands of feet plus 500 when 3,000 feet AGL, Above Ground Level. Radios should be pre-tuned.

Flight Simulator 98 has an annoying bug with multi-engine prop planes. Occasionally the analog Tach reads low by 200 RPM or so. This is a gauge-indication problem; the digital RPM gauge on the overhead panel seems always to be correct. If you notice a discrepancy, always rely on the digital gauge for proper power settings.

V_{mc}, V_1, V_2, V_R--What are they all about?

Pilots must be aware of certain critical airspeeds when flying multi-engine aircraft. These are defined below, in the order that they normally occur, along with the appropriate DC-3 numbers.

- V_{mc} is the Minimum Speed, with one engine failed, that directional control of the aircraft can be maintained.
  - V_{mc}=71 knots
  - NEVER let the aircraft's airspeed drop below V_{mc} in flight except during the flare-out on landing.

- V_1 is the Decision Speed during takeoff. If an engine fails during takeoff before reaching V_1 then you'd abort. If it fails after that, you takeoff. So, you'd abort takeoff if you hadn't reached 81 kts and an engine failed.
  - V_1 =81 knots

- V_2 is the Single Engine Climb Speed.
  - V_2=81 knots

- V_R is the speed to Rotate for takeoff, i.e., the speed that the pilot begins to pitch the aircraft up for takeoff, the speed to pull back the yoke to initiate lift off. The pilot would not rotate before V_R which is always more or equal to V_1.
  - V_R =84 knots

The Takeoff

Start the panel timer, release the brakes and smoothly advance the throttles to 48 in. manifold pressure. Smoothly and gradually advancing the throttle is very important with high horsepower engines--1200 hp each--and tailwheel type airplanes. Always use the maximum allowable power, even though it may appear that conditions do not require it.

With a tailwheel type airplane and the elevator trim set for takeoff, the airplane will normally assume the correct takeoff pitch attitude of its own accord. That is, the tail will rise on its own. Hold the plane on the runway with slight forward pressure until reaching 84 kts and then rotate firmly, but smoothly.

NOTE: V_R for the DC-3 is 84 kts. Rotate at or shortly after attaining that speed.

Abort the takeoff if you experience a malfunction before 81 Kts, V_1. If you experience a malfunction after 81 Kts., continue the takeoff and treat it as an in-flight emergency.

For takeoff, the C-47 Flight Manual states: "Release brakes and advance throttles to maximum power ... Allow the aircraft to accelerate without operating the elevator control, and the tail will rise to level flight attitude between 43 and 52 knots. Continue accelerating and allow the aircraft to fly off at minimum control speed or higher."

Retract the landing gear when there is no longer enough runway underneath for a landing. On lift-off, the airplane should be flying at the correct attitude to accelerate to 105 kts, its best rate of climb airspeed.

> Maximum engine power is limited to one minute duration. After one minute, reduce to the climb-power setting, 36 in. M.P. and 2350 RPM.

Crosswind Takeoffs

Control of the DC-3 during a crosswind takeoff is crucial to prevent drifting off the runway or to prevent "skipping" which produces heavy shear loads on the landing gear.

Power should be applied smoothly, leading with the windward engine in accordance with the amount of wind.

Hold the tail down firmly until positive rudder control has been attained. Do not use brakes at any time unless the ship starts to leave the runway, and all other methods of keeping the ship straight have been attempted.

Roll ailerons into the wind. Ailerons on the DC-3 aircraft are very effective and their use is highly recommended.

The tail should be carried slightly higher than for normal takeoffs to insure that the airplane will not bounce off prior to obtaining flying speed. An inadvertent return to the runway under crosswind conditions places a heavy sheer load on the landing gear.

Tail high takeoffs require speeds 5 to 10 Knots faster than normal. Be sure that flying speed is attained, then definitely pull the airplane off. In this way, there will be little chance of the airplane returning to the runway, thus avoiding sheer load on the landing gear.

As soon as the ship is airborne, center controls with the ship flying level and maintain track of the runway by "crabbing" into the wind. When the takeoff requires crossed rudder and aileron, the controls should be neutralized as soon as possible as they reduce aircraft performance.

Short Field Takeoffs

The DC-3 has excellent short-field takeoff performance, considering its size and weight. In this case, short filed means any runway 2300 ft in length or shorter.

The first difference in a short-field takeoff is that flaps are used, where a normal takeoff is without the flaps deployed. Here is the technique:

- At the end of the runway, drop one-notch of flaps.
- Set the parking brake ON.
- Go to full throttle (F4 key) and when the manifold pressure reaches 48 in, release the parking brake.
- Keep forward pressure on the yoke to prevent too-early lift off.
- Gauge the field length in front of the aircraft during rollout and if runway length permits, lift off at 84 kts.
- In extreme cases, lift off can be as low as 72 kts, then at 100 ft AGL, level off and let airspeed increase to 84 kts, and then continue with a normal climb.
- Don't forget to retract the flaps after assuming a normal climb procedure.
- Be aware that you must get everything "right" the first time on a short-field takeoff; there is no runway in front of you to abort a takeoff.
- Use any available headwind to your advantage, It can be a tremendous help.

Let's try one - you'll be surprised how well you do! This will be the 1200-TO.fsn flight plan from the 1200.zip file that you already downloaded.

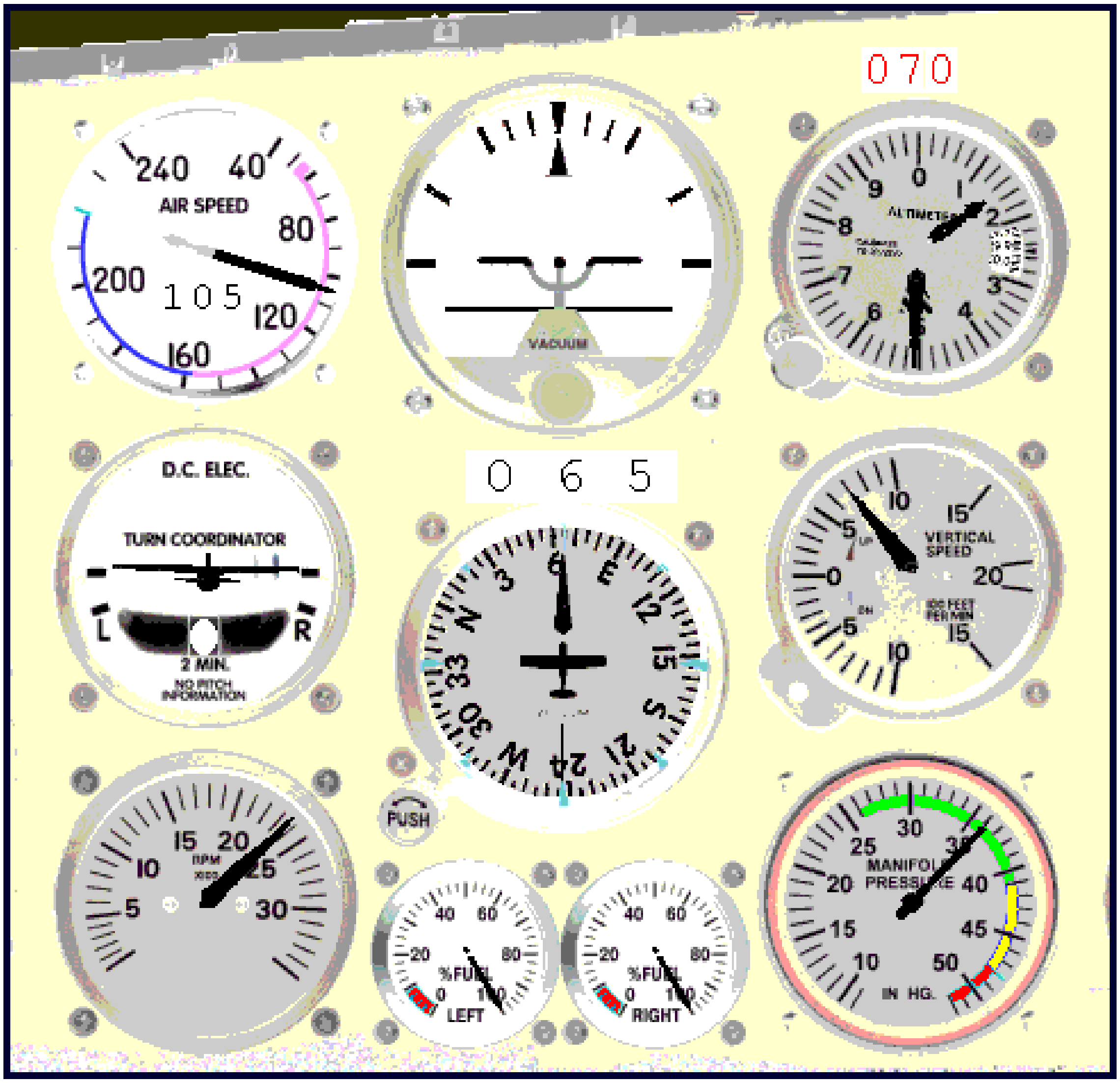
- Move the aircraft to Runway 27 at Myricks Airport, near Berkley, Mass., airport ID is MA18 … for FS2002, the Airport ID is 1M8.
- Drop one notch of flaps.
- Parking brake ON.
- Autopilot OFF
- Auto-coordination ON (unless using rudder pedals).
- Advance throttle to full position (F4 key)
- Release parking brake when MP reaches 48 in.
- Slight forward pressure on yoke to delay lift off.
- Rotate at 75 kts with shallow climb to 100 ft AGL, about 200 ft altimeter.
- Raise gear when positive rate of climb has been established.
- Level off at 100 ft. AGL, allow airspeed to build to 84 kts.
- Retract flaps.
- Continue normal climb to assigned altitude.

You should be airborne in 2000 ft. or less. To judge how well you've done, Pause the simulator as soon as a positive rate of climb is established, then switch to the FSNavigator mode and zoom in on the airport. You'll see how much runway is still in front of you. For this set of conditions, you should be airborne in under 2000 ft.

To see the tremendous gain from a small headwind, set in a wind of 10 kts from 285° and repeat the takeoff, again Pausing when a positive rate of climb has been established. With this headwind, you should rotate at 84 kts and still be airborne in under 2000 ft.

Enjoy the challenge!

Climb



Panel at Climb: 2350 RPM, 36 in. M.P.Best Rate of Climb: 105 knots, 700 fpm

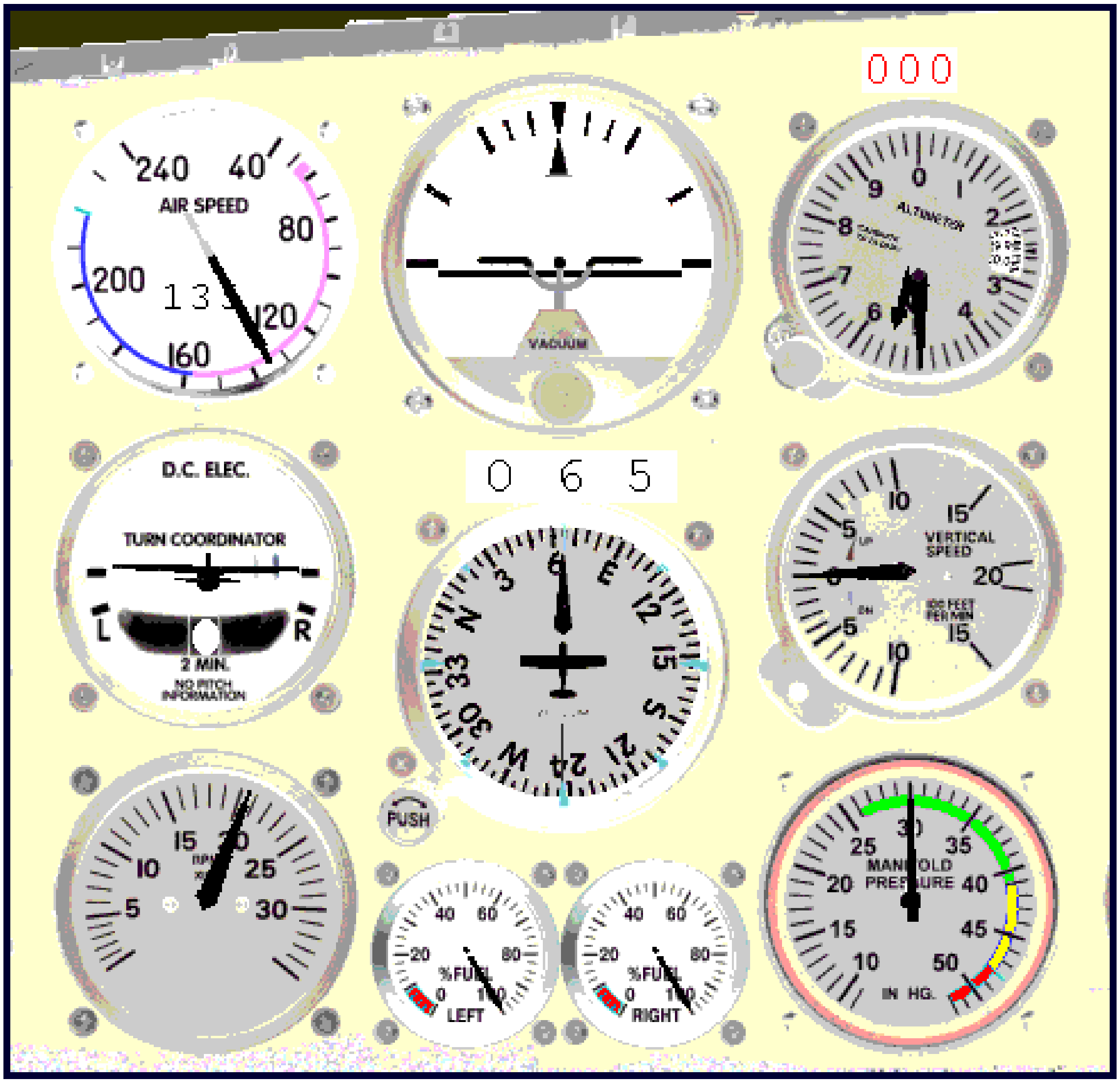
Once a climb rate has been established, smoothly decrease the manifold pressure--throttle--to 36 in., then decrease the propeller to 2350 RPM--Ctrl-F2. Remember, throttle first when reducing power.

As you decrease the RPMs to 2350, notice that the M.P. rises again. Recall the earlier discussion on the interaction between the prop controls and the manifold pressure. So you must again reduce the throttle to bring the M.P. back down to 36 in.

The airspeed should stabilize at 105 KIAS--Knots Indicated Air Speed--with a climb rate of about 700 fpm. Adjust the aircraft heading to track 065° to the Plymouth Beacon, FFF, keeping the ADF needle centered vertically. Climb to 5500 ft.

Pay close attention to the M. P. gauge because manifold pressure drops as the aircraft climbs. Periodically advance the throttle to maintain the desired 36 in. manifold pressure.

Cruise



Cruise: 2050 RPM, 30 in. M.P., 135 knots, 5500 ft.

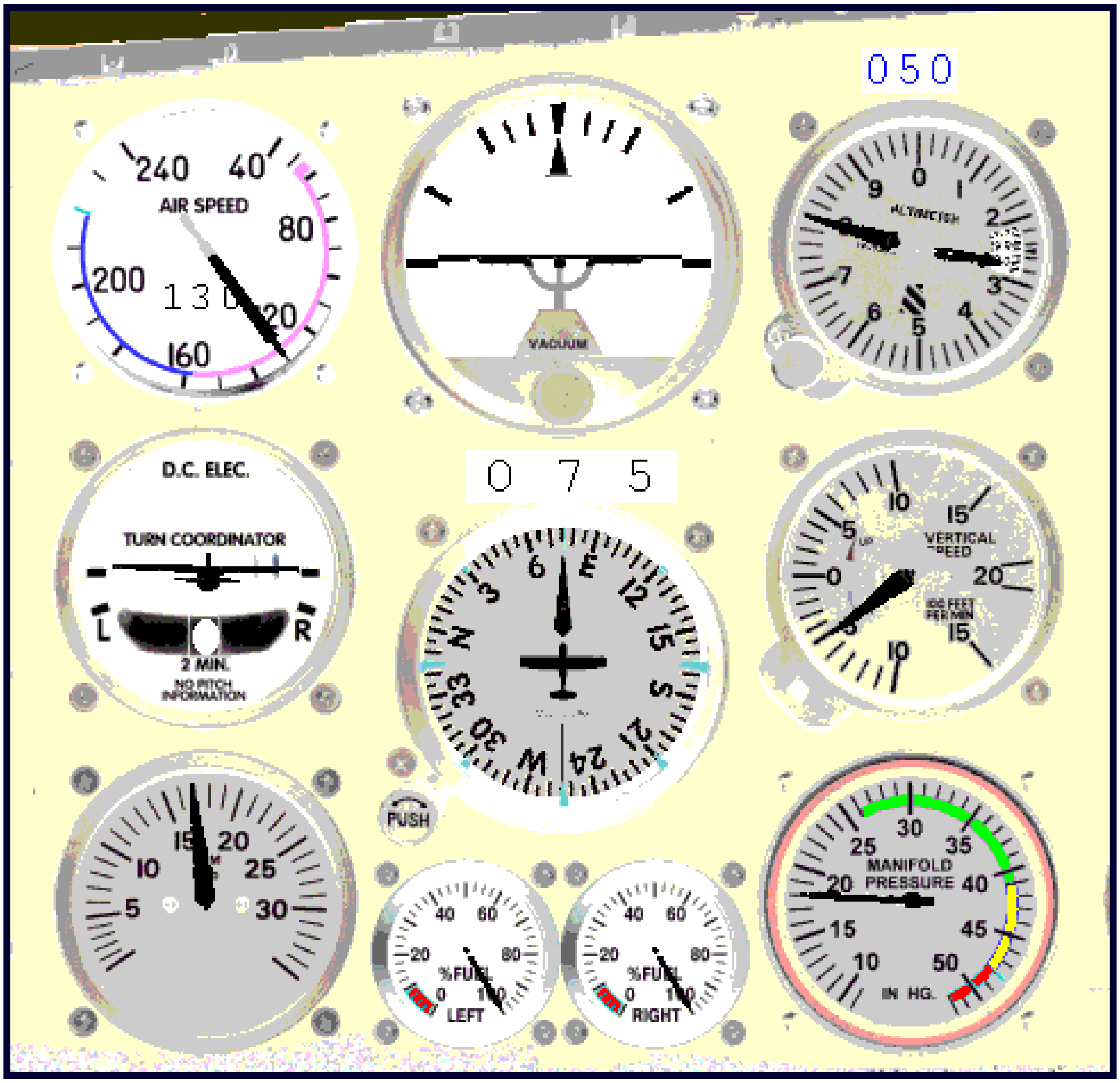
Approaching the cruise altitude of 5500 ft, begin the transition to the cruise configuration.

> The Piedmont DC-3 Flight Manual instructs: "When leveling off, it should be done in such a way that the passengers are not aware of the act. Allow the nose to drop gradually with the rate-of-climb approaching zero. As the airspeed builds up, slowly roll the elevator forward. Do not reduce power until the airspeed builds up to cruising speed."

At cruise altitude back the throttles to 30 in. M.P., (reducing power, throttles first) the propellers to 2050 RPM, and the mixture controls to Auto Lean. Remember to readjust the M.P. to 30 in. after setting the RPMs. The airspeed should stabilize at 135 kts, or so.

The passengers' only perception to this transition should be the change in the engine pitch.

Descend



Descend: 1700 RPM, 18 in. M.P., 130 knots, 500 fpm.

At 5500 ft altitude and with Provincetown near a sea-level elevation, 6 ft., allocate about ten or eleven minutes for descent at 500 fpm. Start the letdown at twenty minutes into this thirty-minute flight. Reduce the M.P. to 18 in.--throttles--and the props to 1700 RPM. Notch the trim down for a 500 fpm, 130 kts IAS descent.

From the Piedmont flight manual: "Never exceed 500 fpm rate of descent, except when necessary to stay on the glide slope during an ILS approach."

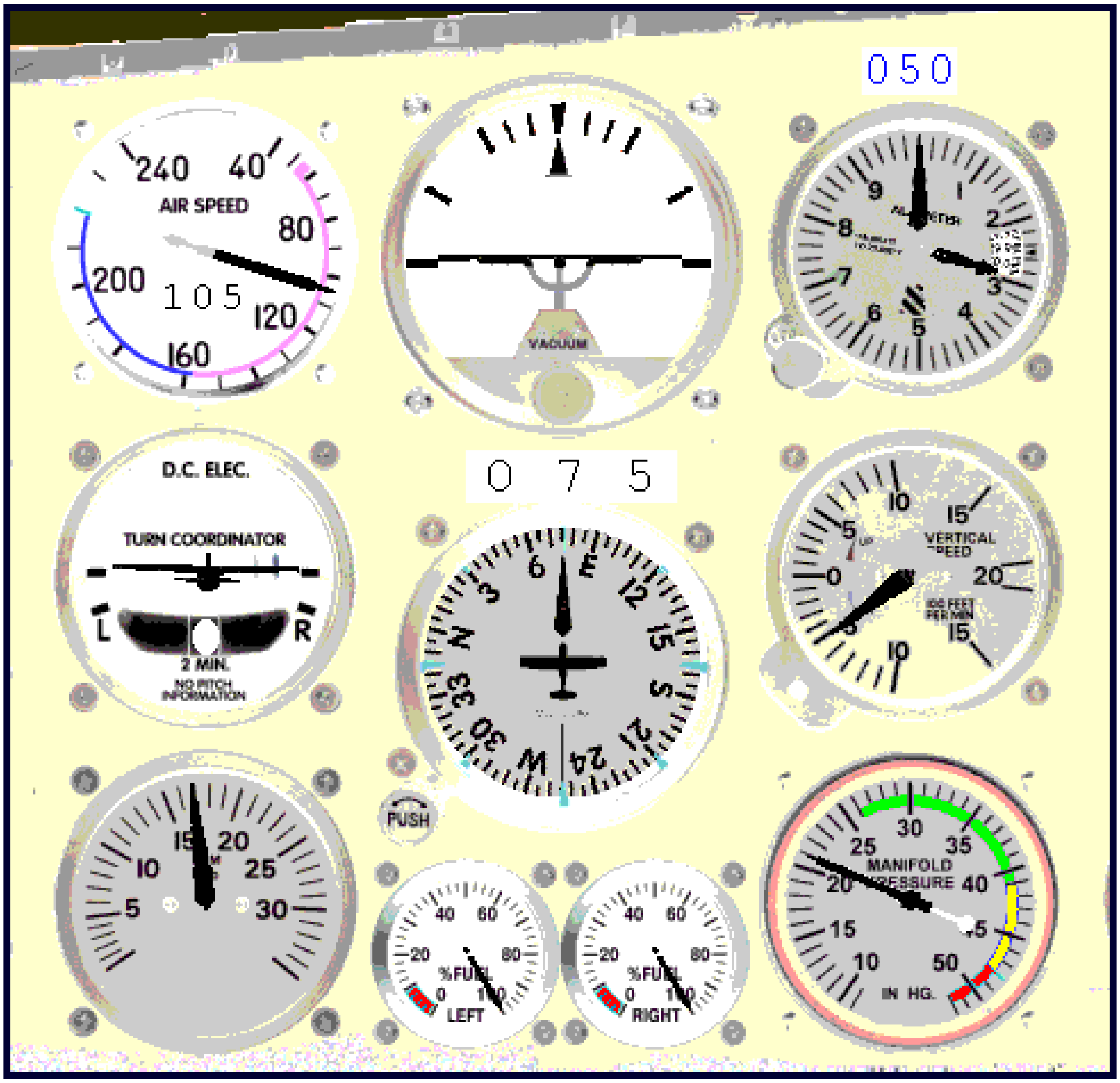
Remember the passengers, don't pop their ears during descent in this non-pressurized aircraft. The math is easy: if you're cruising at 8000 ft, and the airport elevation is near sea-level, start your descent sixteen minutes before expected arrival.

Monitor the manifold pressure during the descent, as it will rise. Maintain it at 18 in. with minor throttle reductions during the descent.

Whenever flight conditions require a large reduction in power, reduce RPM as well as manifold pressure. As a rule of thumb, remember that each 100 RPM requires at least 1 inch Hg manifold pressure; for example, 23 inches Hg at 2300 RPM. Operation at high RPM and low manifold pressure should be kept to a minimum.

Never exceed 2325 RPM during descent.

Approach



Initial Approach: 1700 RPM, 21 in. M.P.,one-notch of flaps, 105 knots, 500 fpm.

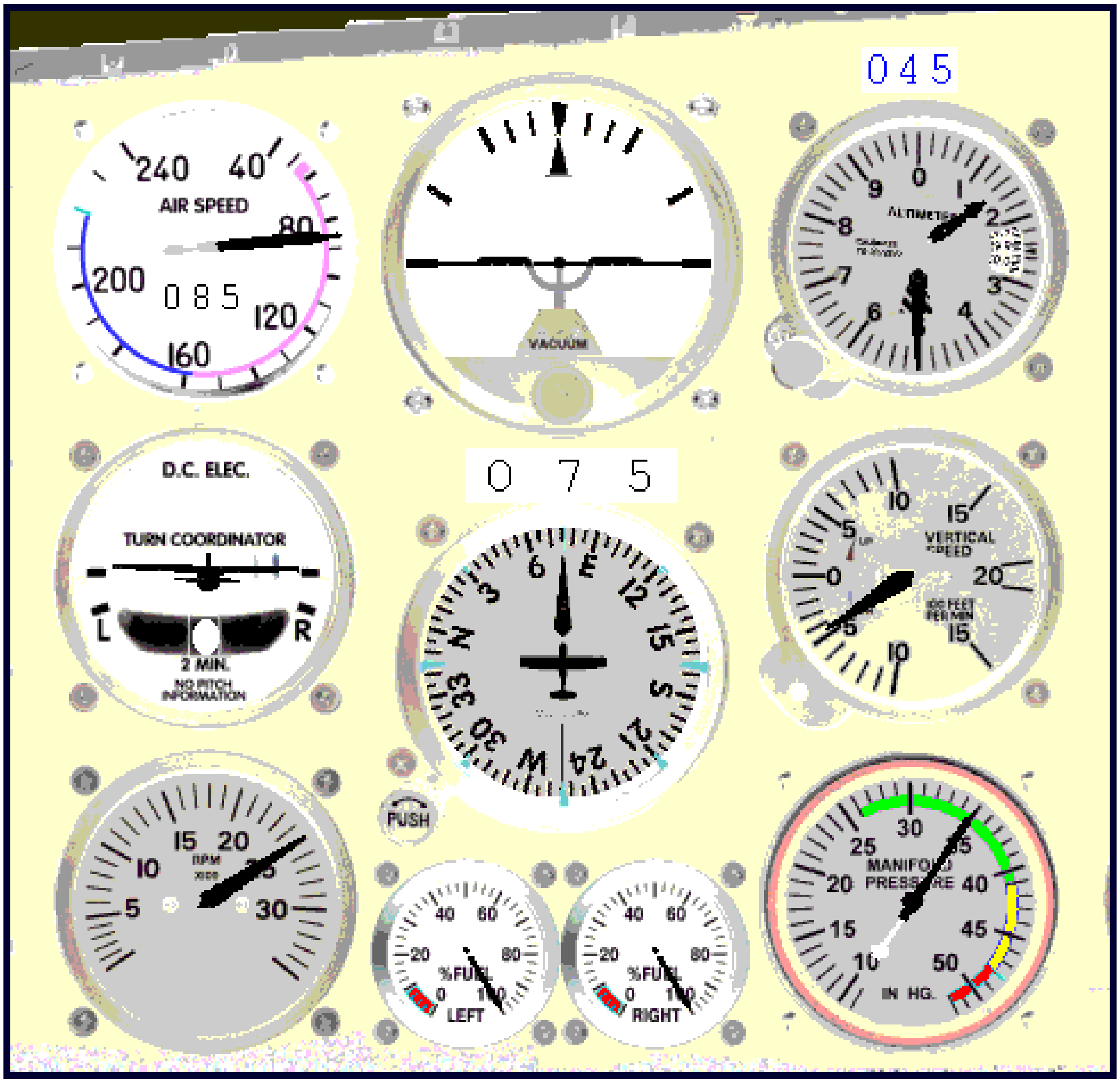
While every flight segment is important, the approach is the most crucial. A good landing can only follow a satisfactory approach, and the converse is true.

Information in this section pertains to VFR flights only. Instrument approaches, whether NDB, VOR, or ILS, are covered in later sections.

Here's where the flight gets busy. A straight-in approach has been approved, so set up for the initial approach at 3000 feet AGL. Slow the aircraft from its normal descent speed to a manageable 105 kts. Drop one notch of flaps--139 kts max., leave the gear up, pull the throttles back to 21 in. M.P., and the props back to 1700 RPM.

Retrim as necessary to continue the 500 fpm descent at about 105 kts IAS.

About five miles from the airport transition to the final approach configuration.



Final approach: High RPM, Gear down, full flaps, throttle to 2500 RPM, 85 kts IAS.
Hold 500 fpm or what's needed to touch down on the approach end of the runway.

At about 1500 ft (VFR flight only) transition to final approach. Bring the speed back to 85 kts, lower the gear, and drop full flaps--99 kts max. Push the props to high RPM, Ctrl-F4. Be alert; with everything down and dirty you will need to increase the power and raise the trim to maintain your desired rate of descent. Don't let the sink rate become excessive and mess up your approach.

The props are in the high RPM so that you need only shove the throttle forward if a go around becomes necessary. For the transition to final approach initially increase the throttle to 2500 RPM, but:

Control the rate of descent with the throttle.

Hold 85 kts on final approach, with full flaps. If there are strong gusts, add half the gust speed to your final-approach speed. For example, if the wind is 12 kts, gusting to 20, the gusts are 8 kts. Add half of that, or 4 kts to your final approach speed of 85 kts, which gives you 89 kts on final. Diligently maintain the exact final approach speed. Don't add an extra knot for each of your children and grandchildren.

If the approach isn't "just right," a sloppy landing will follow. The importance of a good approach can't be overstated.

How do I know if my rate of descent on final approach is correct?

Laterally lining up with a runway is fairly easy. It's less obvious, though, to ascertain whether your established rate of descent will lead you to the runway, send you too far, or drop you too short.

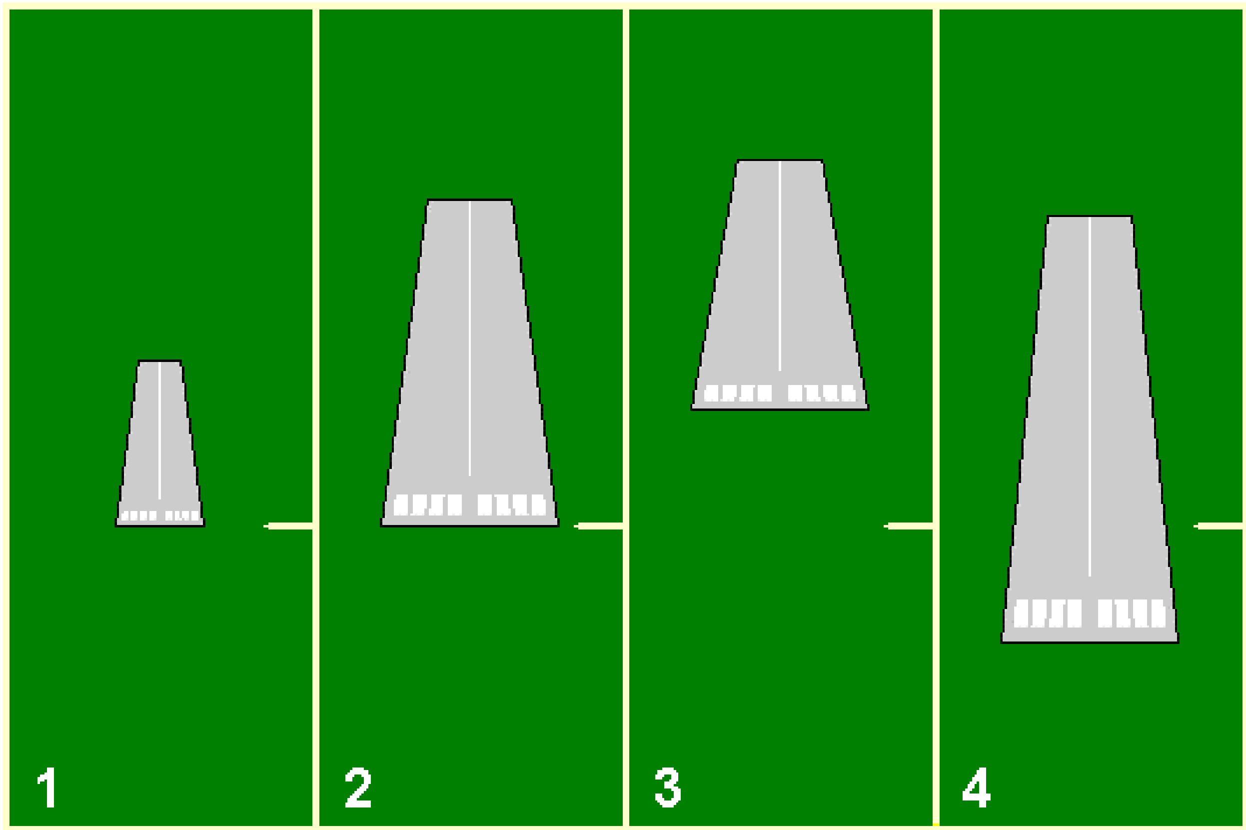
The pilot has two aids to help in this task. The first is visual cues. The aiming-point technique will improve all of your landings.

Begin by focusing your attention on the threshold end of the runway. That will be your aiming point. The object is to adjust your rate of descent so that the aiming point does not move during your entire approach to land. The aiming point should only grow larger in size as you get closer.

A china marker pencil will help you learn this technique until you have a few landings under your belt using this method.

After you begin your descent to the runway and everything is fairly stable, pause your Flight Simulator and mark a line on the monitor beside the approach end of the runway, to emphasize your aiming point. Then continue your approach. The end of the runway must not stray from the line you drew on the screen.

If you have set your rate of descent precisely correct, it will be as if you're suspended in air; there will be no movement of the runway as you approach. It will almost be eerie. Any movement of the approach end of the runway signifies that the point of your actual landing will differ from your point of intended landing. Here are the possibilities:



1. Aiming point established at yellow mark.
2. No movement of the runway threshold as you near the airport. The rate of descent is perfect.
3. The runway threshold is creeping up the screen as you approach. The landing will be short; the rate of descent is too high. Pray that there are no schools or hospitals below.
4. The runway threshold is creeping down as you approach. The landing will be long; the rate of descent is too low. Pray that no 20-story condos are at the end of the runway.

Once you alert your senses to discern any movement of the runway threshold, this becomes a very natural technique to use when landing.

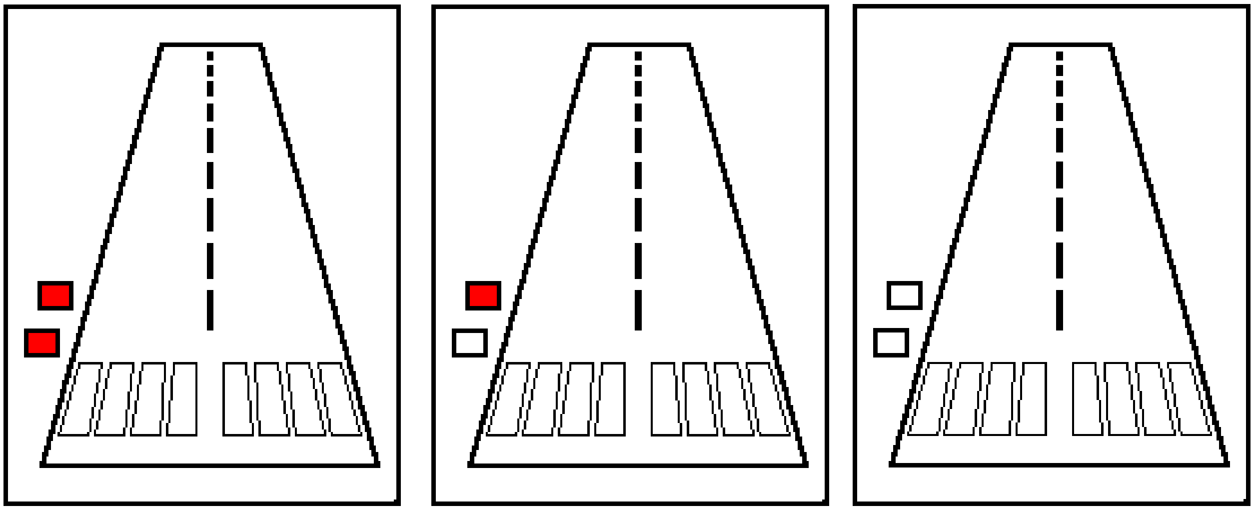
Remember, again. Adjust rate of descent with power, the throttle, not by changing the position of the yoke.

VASI System

The second aid to help pilot's set the correct rate of descent is the VASI system, or Visual Approach Slope Indicator.

VASIs come in several varieties, but a typical system includes two sets of light bars placed on the left side of the runway, one nearer the landing threshold than the other. Lenses split the light into red and white beams.

Three combinations of lights exist with this arrangement. If you're approaching the runway on the proper glide path, usually a three-degree slope, you'll see a red light above a white light.



Left, "Red over red, you're dead," approach is low. Center, "Red over white, you're all right," approach is perfect. Right, "White over white, you'll fly all night," approach is high.

Intuitively, of course, one understands that red-red is "danger," or low, and then the others become obvious.

Establishing a three-degree glide path

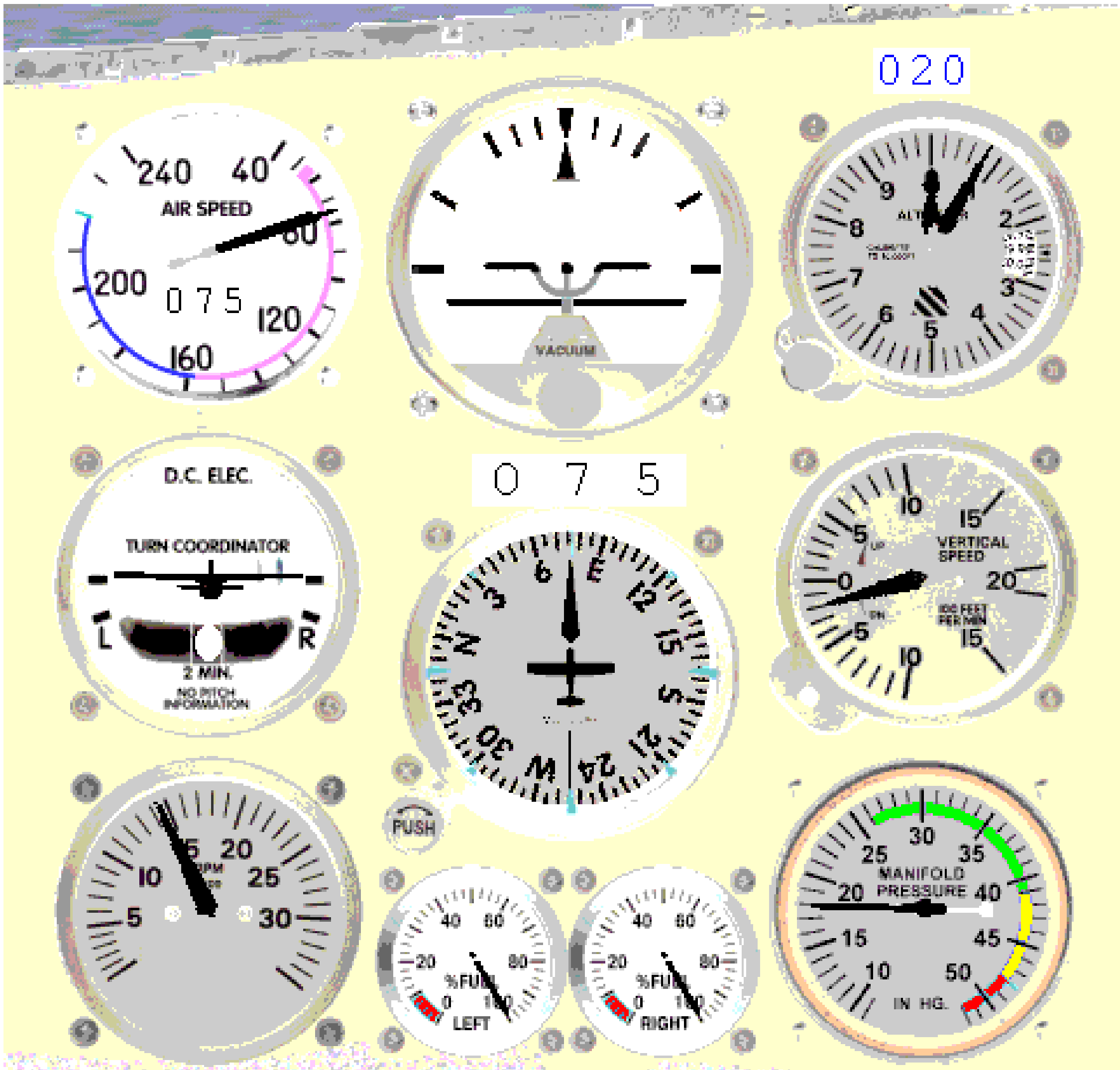
A three-degree glide path for landing is considered optimum. Most VASI and ILS systems are designed with that glide path.

The rule of thumb for the proper rate of descent to maintain a standard 3° glide path is five times the aircraft's *ground speed*. With an 85 kt approach speed, no wind, the rate of descent should then be 5 x 85, or about 425 fpm. If you're battling a 20 kt headwind, ground speed reduces to 65 kts, and the needed rate of descent lessens to 325 fpm.

These are approximate numbers and are on the low side, but this rule of thumb gets you established close enough so that only minor power adjustments will be necessary to maintain the optimum three-degree glide path.

The mathematically correct rate of descent for a DC-3 approaching at 85 kts is 451 fpm (no wind) to stay on a 3° glide slope. So the rule of thumb keeps you slightly above the glide path, the good side to be on if not centered.

Landing



Landing: Slow the rate of descent and airspeed in preparation to flareout and touchdown.

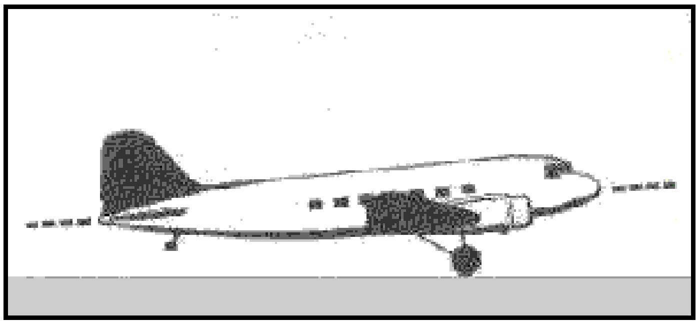
The old cliché on flying is that a good landing follows a good approach. That certainly is true. If your aircraft isn't lined up with the runway to your satisfaction, final approach is not the place to be dancing about to make things right. If things aren't right, do a go-around. That procedure is covered in the next section.

NOTE: Whether you fly the DC-3 with or without the autopilot, you should always manually fly the final approach. Turn OFF the autopilot-Press the "Z" key-and if you aren't using rudder pedals, turn OFF the auto-coordination switch with a click of the mouse.

Now, if everything is OK on final, you're nearing the runway, satisfied with your alignment, full flaps are down, your final approach speed is nailed on 85 kts, you're having a hard time keeping the smile off your face, and the landing is assured, pull back the throttles to bleed off the speed. Cross the fence at 75 to 80 kts, and smoothly, without floating, flare out and touchdown at 70 kts, just slightly above stall speed, to the applause of your passengers.

Don't lose it at this point, though. More landing accidents occur when a pilot loses control of the aircraft after touchdown than any other phase of the landing. Keep flying the plane even though it has touched down. Stay on the runway, keep the tail low with back-pressure on the yoke and sparingly apply the brakes--nothing ruins a flight quite like a nose-over.

From the C-47 Flight Manual: "Touch down main wheels first in a slight tail-low attitude. When the main wheels contact the runway, check power off, relax pressure, flaps up. As the aircraft decelerates, lower the tail wheel gently on the runway ... maintain back pressure on the column until the landing roll is completed."



A tail-low landing is normal for the DC-3.

If wing flaps are used in high-wind conditions, retract them as soon as the wheels touch the ground to prevent "ballooning."

Fun, wasn't it? A thirty-minute flight, and you practiced throttle- and propeller-control management for takeoff, climb, cruise, descent and approach.

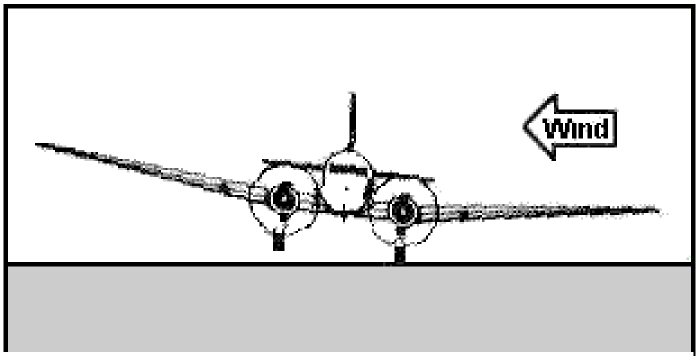
Got a little exposure to the ADF and Localizer, too. The more you learn, the more fun it is.

Note: If after flying the Newport to Provincetown route a few times you find that your power and trim settings differ slightly from those on the checklists, simply edit the dc3_check.cfg file.

Crosswind Landings

A crosswind landing in a DC-3 is not the time to let the mind wander or the aircraft may just wander off the runway, or worse, ground-loop.

On final approach, keep the nose of the airplane lower than usual and use no more than half flaps when the crosswind component exceeds 12 kts. Touch-down, using a combination of drift correction and wing-down to keep aligned with the runway. When the wind is gusty, increase the final approach speed approximately 8 knots. At approximately 100-200 feet above the runway, align the nose of the airplane with the runway with rudder control and increase the amount of "wing-down" into the wind.



Wing low for crosswind landing.

When you reach the normal flare-out point, slow the airplane to minimum touchdown speed and decrease the rate of descent. Fly the airplane onto the runway at the minimum touchdown speed. Avoid a three-point landing because of the probable bounce and drift and don't let the airplane touchdown while drifting sideways.

Keep the nose aligned with the runway by use of rudder control, and compensate for drift across the runway by increasing or decreasing the amount of wing-down correction. When the wheels contact the runway, ease the control column forward slightly, flying the downwind wheel onto the runway. Adjust the power of the upwind engine as necessary and direct the co-pilot to raise the flaps. Gradually increase the amount of aileron pressure into the wind as the airplane decelerates. Maintain directional control with rudder, differential power and brakes.

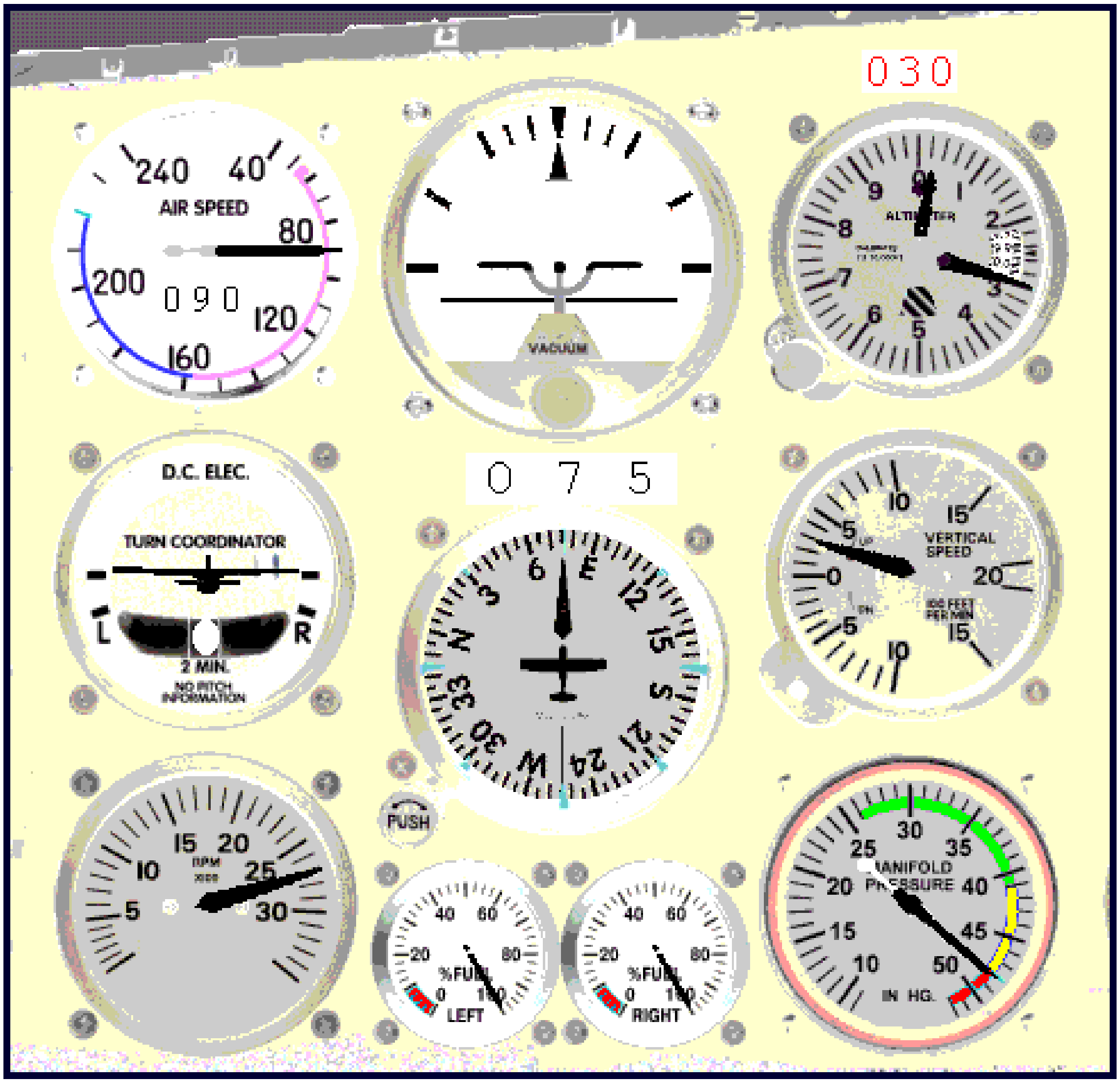
Horizontal gusts affect an airplane much less with flaps retracted.

Short-Field Landings

The procedure for a minimum run landing is the same as for a normal power-on approach - power-off landing, except for the following differences: Under most minimum run landing conditions, it is preferable to make a wheel landing rather than a 3-point landing. A wheel landing allows better control for immediate use of brakes to come to a quick stop. Retract the wing flaps immediately upon contact with the ground. This will prevent the aircraft from leaving the ground again and thus make the brake more effective.

Exercise caution when using this technique on sod fields since the possibility exists of locking a wheel and digging in.

Go Around



Panel at Go Around: Full throttles, Retract flaps to one-quarter, don't raise gear until 1000 ft. AGL, then go to slow-flight configuration.

There's very little reconfiguring of the aircraft needed on a Go Around, which is as it should be. The pilot's total focus should be on flying the aircraft and safely gaining some altitude.

On a go around responsively, but smoothly, shove the throttles forward to full power--48 in. MP. (Pressing the F-4 Key will do that). The props were already moved into the high RPM position during approach in preparation of a go-around, if necessary. Stop the descent; raise the flaps up to the first notch, one-quarter, but leave the gear down for the moment. Don't let the aircraft sink as the flaps bleed off.

You might wonder, as I did, why raise the flaps before the gear on a go-around? Here's the wonderfully succinct answer I got from one DC-3 captain when I raised this question on a forum. I thought a pilot would want to "first eliminate the horrible drag of the landing gear."

> "If you were to sink towards the runway on a go-around, would you rather have flaps or gear? The split flaps on the DC-3 create more drag than lift, and the drag from the gear is not horrible.

In a single or twin, it's never gear up until a positive rate of climb is established, and that is difficult if not impossible with full flaps."

Another DC-3 Captain justified raising flaps first this way:

> "It´s pretty simple, DC-3 has split flaps. At full flaps it generates approximately 200% drag and 35% lift."

Don't be in a hurry to gain too much altitude. Continue to bleed off the flaps, climb out at 90 kts and 300 fpm. Once a positive rate of climb has been established, reduce the power to climb, 36" MP, 2350 RPM, and raise the gear. At 1000 ft. AGL reduce the throttles and props to the slow-flight configuration for another try or to enter the holding pattern.

If circumstances force you to another destination, then stay in the climb configuration and go to the assigned altitude and be on your way.

Testing Your Go-Around Skills (and Short-Field Landing Techniques)

This will be Flight Plan 1200-0b8 from the 1200.zip file already downloaded.

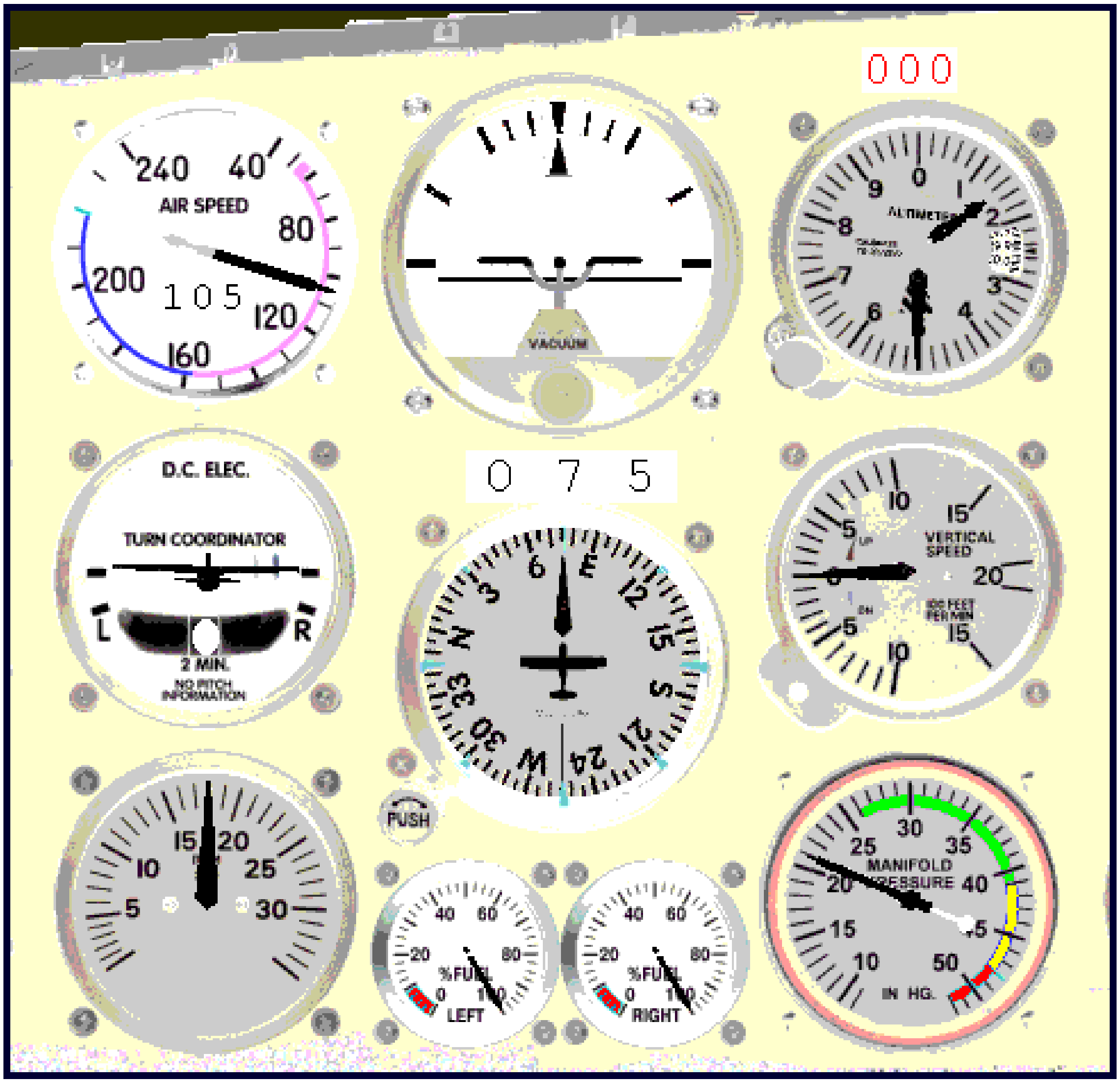
- **Set weather to unlimited visibility, scattered clouds and zero wind.**
- **Depart Runway 23 of KOQU**
- **Turn right to heading 245° for Westerly Airport, about 21 NM distant.**
- **Climb to 3000 feet.**
- **At Westerly Airport, turn right to 255°, slow to 105 kts, and begin descent.**
- **Set up for a straight-in approach to Runway 25, Elizabeth Field. The field is at the far end of Fishers Island and you should see the Island on passing Westerly Airport.**
- **Lower landing gear and flaps, slow to 85 kts.**
- **At 1500 ft go to full flaps, slow to 75 kts approach speed.**
- **At 200 ft altitude, exercise the Go-Around procedures.**
- **(F-4 Key for full throttle.)**
- **Climb to 1000 ft.**

- **Return and enter a left-traffic pattern to land on Runway 25.**
- **Approach speed on final should be 75 kts with full flaps.**
- **Submit your time for this flight on the PIREP form ... Flight No. is 1200-0B8.**

NOTE: Be forewarned, Elizabeth Field's Runway 25 is too short for a DC-3 to take-off from. Use Rwy 12/30 for take-offs. It is 2324 ft in length.

This is a favorite "take-a-break" flight for me. Short, easy, but challenging on the approach and landing. Plus you get to exercise all nine segments of a flight. You're likely to put it in the same "favorite" category.

Slow-flight



Slow-flight: 1800 RPM, 21 in. M.P., 105 kts.

The normal slow-flight procedure is useful either following a go around or when entering a standard traffic pattern for landing. A second type of slow flight, flown during NDB or VOR instrument approaches, is described a little further down the page.

The situation immediately following a go around illustrates the procedures for normal slow flight.

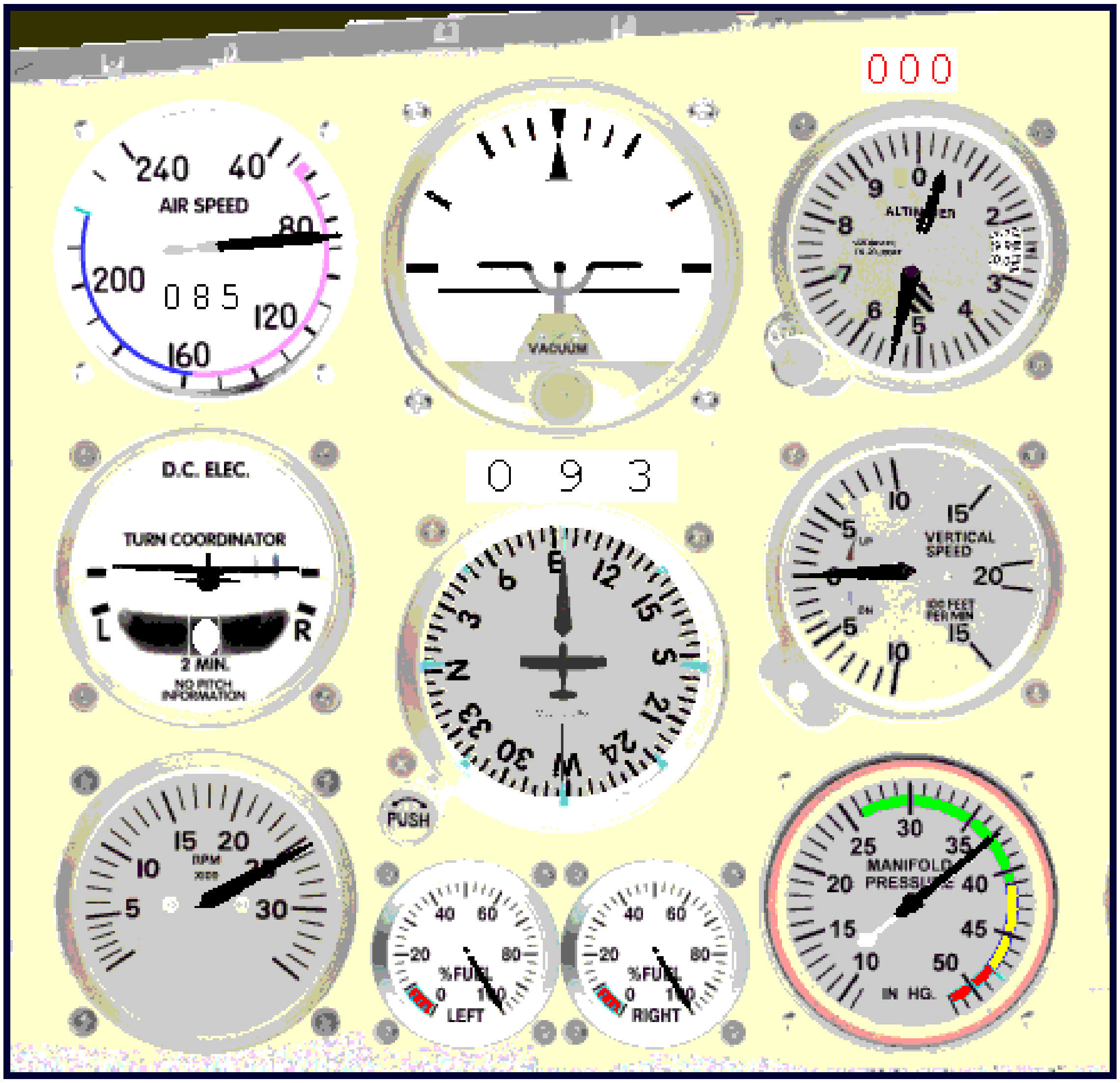
Level off at 1500 ft AGL, reduce the M.P. to 21 in.--throttles-- and reduce the props to 1800 RPM. The IAS should read 105 kts and the aircraft should maintain 1500 ft. Do not change your heading following a go-around until the slow-flight configuration has stabilized, except when the missed approach procedure requires immediate action, or ATC assigns you a new heading, or you are headed directly into a mountain or the Empire State Building--both unlikely at Cape Cod.

Other slow-flight circumstances will dictate the flight altitude.

Slow flight during instrument approaches

NDB and VOR instrument approaches, often called "Dive and Drive" approaches, require a second type of slow flight. As the aircraft proceeds inbound to the field, once it reaches the FAF, the Final Approach Fix, it descends as rapidly as possible, "Dives," to the MDA, the Minimum Descent Altitude. From that point on it maintains the MDA, "Drives," until either the runway is sighted or the clock tells you that you have missed the field and must do a go around.

This slow-flight configuration differs from that previously described in that the aircraft is near the landing configuration: half flaps are down, the gear has been lowered, and the props are in High RPM. Everything is controlled with the throttle. At this point you are really dragging in; approach speed will be the same 85 kts for any other type of landing.



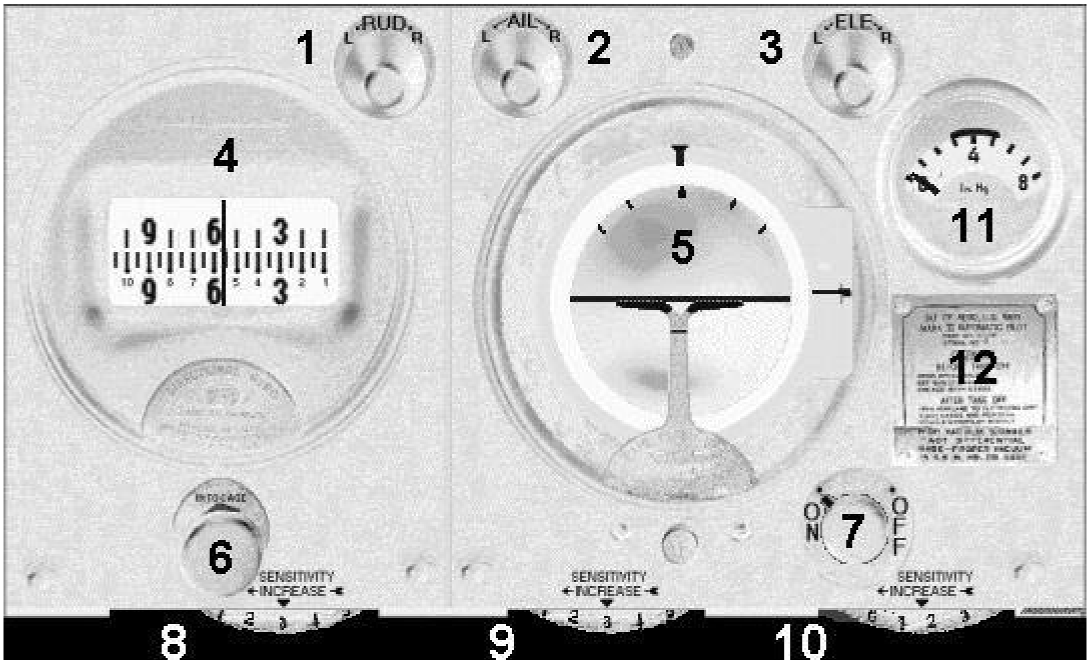
Level Approach: Props High RPM, throttle 2550 RPM, half-flaps, gear down, 85 kts. Gauges here reflect an NDB approach to Provincetown.

The level approach permits the pilot to concentrate solely on flying the aircraft, a particularly desirable situation when the ceiling and visibility are near minimums for landing.

Note the headings in this NDB approach panel-photo. The approach is to Provincetown's Runway 7, which has a 075° alignment, but the aircraft heading is 093°, requiring an 18° jog to the left to line up with the runway on sighting the threshold. In this instrument approach, the NDB is located on the field, and obviously must be located a safe distance to side of the runway rather than directly in front of the runway, hence the angular approach. If the NDB (or VOR) were located off the field, usually about 5 NM distant, it is almost always directly aligned with the runway heading, simplifying the approach.

Many of DC-3 Airways flights require either an NDB approach or a VOR approach. Refer to the Navigation Tutorial, http://www.navfltsm.addr.com/ndb-nav-adf-1.htm , for full information on how to fly those sort of approaches. In many ways, they are more fun to fly than a standard ILS approach. Don't pass them up.

Using the Sperry Autopilot



The "Sperry Gyropilot for Aeroplanes" was a remarkable invention. It was superior to other designs since there was no direct mechanical linkage to the gyroscope, thus preventing the possibility of the sensitive gyro element being disturbed.

There is a natural tendency for a pilot to distrust any mechanical device which its designers claim will do a job that formerly depended on his own skill and experience. It is almost an aggravation to find one's aeroplane is being flown as accurately under automatic control as when it is receiving all the concentrated attention on the part of a human pilot to maintain course and altitude.

In time, airline pilots overcame these prejudices, if not quite ready to admit that the "Gyropilot" might even fly the aeroplane more accurately than they.

The Sperry Autopilot is a fun instrument to fly. It requires much more attention than the more modern autopilots, but all of this adds enjoyment to flying the DC-3. Once you have gone through the explanations below, you'll excitedly turn the Sperry on for many of your flights.

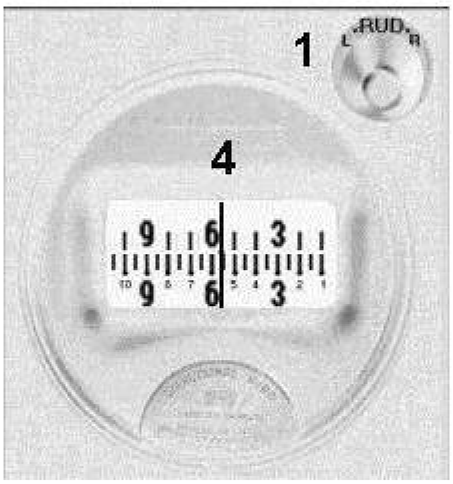
NOTES:

Engage the Sperry Autopilot AFTER dialing in the correct heading setting. The Sperry will neither turn an aircraft to a specific heading nor climb/descend an aircraft to a specific altitude. Its function is primarily to maintain a heading that you dial in or to maintain a pitch setting that you dial in. Read the control explanations below for a better understanding.

The rudder Auto-coordination in Flight Simulator must be in the OFF position for the Sperry to properly function.

You will find that the Sperry Autopilot is very easy to understand, and a very straight-forward instrument, once you have read these operation procedures,. It's a lot of fun piloting an aircraft with the Sperry engaged because you are actively in control at all times. You won't be dozing at the controls at all.

The Sperry Autopilot Controls

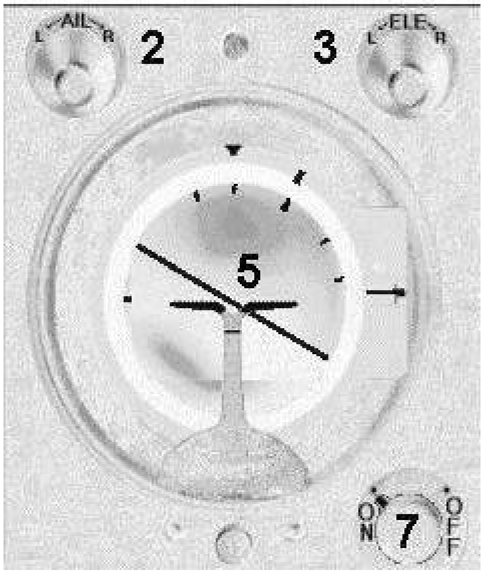


Align the upper and lower heading scales, #4, using the Rudder control, #1, before engaging the autopilot.

1) **The Rudder Control.** This is the primary autopilot control for maintaining the aircraft heading. Unlike modern autopilots, the Sperry controls heading with the rudder, not the ailerons. This is why auto-coordination must be switched OFF when using the Sperry.

The lower scale portion of the heading indicator (4) is a directional gyro similar to the primary directional gyro on the aircraft panel. Mouse-Click on the Rudder Control (+ turns the aircraft right, – turns the aircraft left) until the top scale and bottom scale are in alignment as shown to the left. Do this after the aircraft is stabilized on the desired heading, not while it is in a turn. The autopilot should be in the OFF position, as Knob #7 shows in the previous illustration.

Once the autopilot is engaged, you may vary the heading a few degrees to the left or right by mouse-clicking on the Rudder Control, #1. That is the procedure, for example, to center the localizer needle on the ILS.



Use knob #2 to manually turn the aircraft, as shown on the Sperry artificial horizon, #5.

2) **Aileron Control.** Use the Aileron control, #2, to manually turn the aircraft to a new heading. It takes a little practice to learn how much to lead the new heading when you roll out from a turn. Obviously, one can only perform this function when the autopilot is engaged, knob #7.

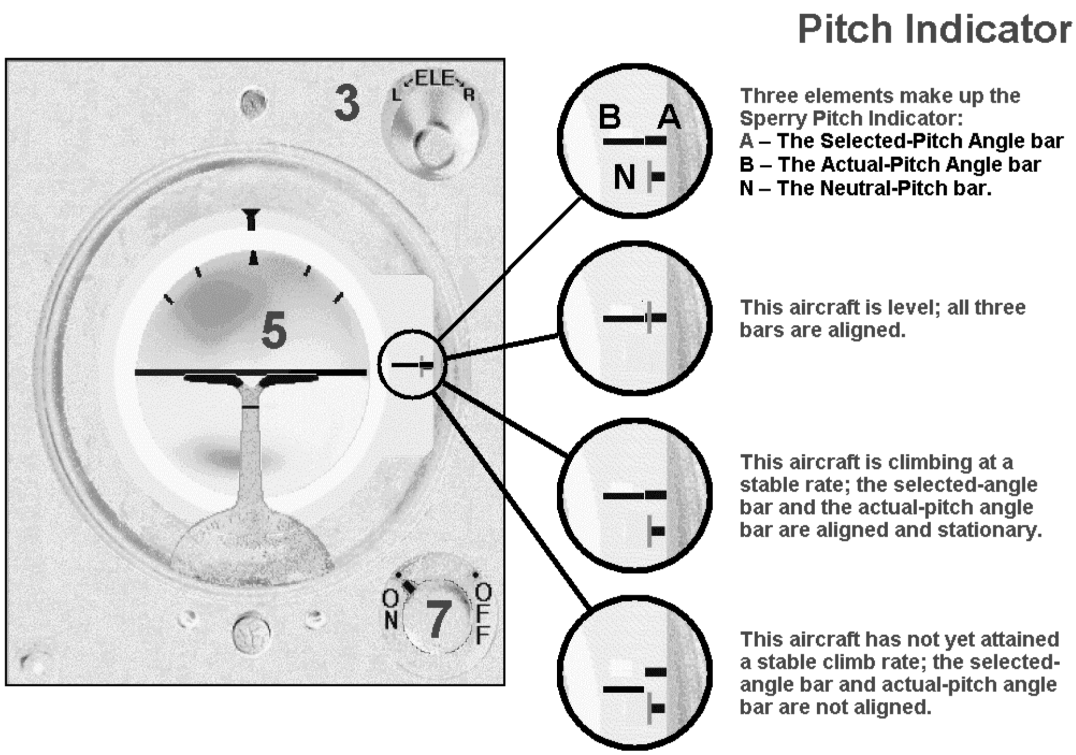
The illustration shows the aircraft in a left turn established with the Aileron control. The artificial horizon (#5) on the Sperry functions in the same fashion as the one on the main aircraft panel.

When the aircraft is flying straight under the Sperry control, be certain that the wings in the indicator are absolutely level, else the rudder will try and compensate for the bank of the wings to maintain straight flight.

3) **Elevator Control.**

Controlling aircraft pitch with the Sperry autopilot is easy. "Rotate" the "Elev" knob, #3, by clicking on it. The plus sign that appears when the mouse is on the knob indicates a positive climb, while the negative sign indicates reducing the climb or an actual descent.

The pitch indicator is on the Sperry Artificial Horizon, at the right hand side of the gauge, as the illustration below shows. The illustrations also includes explanations of various pitch indications.



Summary of Sperry Autopilot Control Functions

(Refer to first illustration)

Item	Function
1	Heading knob. Set the heading to coincide with the aircraft heading while in straight flight.
2	Manual Turn Knob. Click to manually turn the aircraft. Be certain to return wings to absolute level position.
3	Elevator Knob. Set desired pitch of aircraft climb or descent. Monitor with the Vertical Speed Indicator.
4	Heading Indicator. There are two scales here. The lower scale indicates the actual heading of the aircraft just as the standard DG on the panel. The upper scale, adjusted with Knob #1, is the desired heading.
5	Artificial Horizon. Use this to monitor both manual turns, Knob #2, and for pitch adjustments, Knob #3.
6	Autopilot DG adjustment. This knob adjusts the lower scale of the heading indicator to match the compass heading. It is only necessary to adjust this knob if you have selected "Gyro Drift" in Flight Simulator.
7	On–Off switch. Do not engage the autopilot until the aircraft is trimmed on the desired heading and the two heading scales match in reading.
8	Sensitivity adjustment for heading. Initially set at "3" and readjust as needed for desired sensitivity.
9	Sensitivity adjustment for manual turns. Initially set at "3" and readjust as needed for desired sensitivity.
10	Sensitivity adjustment for pitch control. Initially set at "3" and readjust as needed for desired sensitivity.
11	Vacuum gauge. The Sperry Autopilot. relied on a vacuum source to function properly. This gauge shows the acceptable range of vacuum.
12	Click here for the Autopilot Help screen.

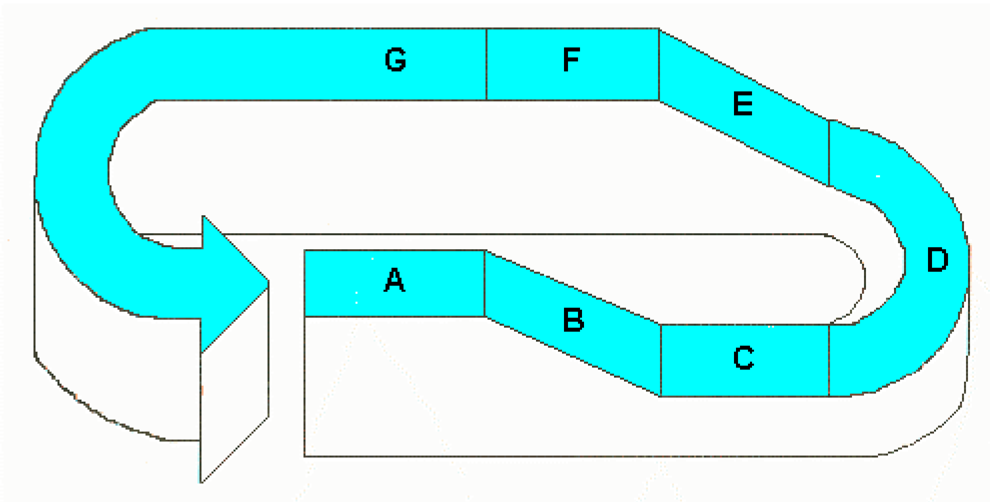
IMPORTANT!! Be certain to advance the sensitivity knobs to about "3" – If they are at "0," the autopilot will not function.

Fun Flights

Before moving on, there is one more flight routine that will really sharpen your flying skills. Appropriately enough, it's called:

Practice, Practice, Practice

This practice session is fairly simple, incorporating airspeed control, level turns, descents and climbs. Fly the practice pattern with the FS-98 visibility and ceiling set to minimums so that you have only the instruments for reference. All later flight maneuvers will be simple once you have mastered this pattern.



Seven minutes is all it takes to fly this practice pattern.

Begin the flight at 1000 ft AGL, then:

A. Slow to approach airspeed, and fly straight and level for one minute.
B. Begin a descent for one minute at approach airspeed and a 500-fpm rate of descent.
C. Level off at 500 ft, and fly one minute at approach airspeed.
D. Make a level, standard-rate turn. Remember that a standard-rate turn is 3 degrees per second. Make this turn for one minute, which should result in a turn of 180 degrees.
E. Climb for one minute at climb airspeed and a 500-fpm rate of climb.
F. Here you should be at your initial 1000 ft altitude. At this point, accelerate to cruise airspeed and cruise power.
G. Make a standard-rate level turn for one minute, rolling out on your initial heading.

When you fly this pattern the second time, make the turns in the opposite direction, and alternate the directions of the turns from then on.

During the descent segment--B--you should use as many different aircraft configurations as you can. In other words, make one simulated approach in the clean configuration, using only power to adjust the rate of descent. Then, make a descent by lowering the gear, adjusting power as necessary to maintain a 500-fpm descent. Finally, use various flap settings, with and without the gear, paying attention to the specific pitch attitude and the approximate power setting needed for each type of descent. This sounds complicated, but the variations are only for one segment, B.

Next, fly the level turn segment--D--with the gear down and the flaps in the clean and the proper maneuvering position. No matter what configuration you are using in segment D, you have to remember to clean up the aircraft--raise the flaps and gear--when you begin the climb in segment E.

Learn the DC-3 thoroughly. Practice this pattern once a day until controlling the aircraft becomes second nature, which will happen sooner than you think.

Practice until:

- You can change the gear and flap configurations without gaining or losing any altitude.
- The airspeed remains nailed where you want it.
- One minute of descent results in a loss of exactly 500 feet, one minute of climb results in a gain of exactly 500 feet, and the one-minute turns come out to exactly 180 degrees.

Once you have mastered this basic pattern, you can make one change in it that will turn it into a procedure that at one time was part of all ATP flight tests: the *Canyon Approach* was, and is, an excellent test of aircraft control.

As the captain of an aircraft, you have been cleared for an approach to an airport located in a canyon. You reduce power to approach airspeed in segment A. At the beginning of segment B you cross the initial approach fix--a radio beacon theoretically located on the rim of the canyon--at 1000 ft, lower gear and flaps, and descend to a minimum descent altitude of 500 ft.

Once down to the 500 ft minimum descent altitude, you fly out the allotted time, which in this pattern is depicted as segment C--one minute at approach speed--and when you don't see the airport, you initiate the missed approach procedure. In this case; the missed approach procedure calls for an immediate 180-degree climbing turn as depicted in segment D, which will take you back to the 1000 ft initial altitude. Naturally, the gear and flaps must be retracted during the wave-off.

The one change you have made to the original practice pattern is that you no longer make that nice level turn at D. Instead, you have combined segments D and E into a climbing turn. Still, it's necessary to be at the initial altitude and the reciprocal heading as you complete the one-minute climbing turn.

Courtesy, J. R. Williams, *The Art of Instrument Flying*

Checklists

PRE-TAKEOFF
Brakes Set.
Flaps fully up.
Auto-Coordination On.
Autopilot Off.
Tune Radios and set VOR OBS.
Elevator trim to 58.
Propellers to High RPM (Ctrl-F4).
Pan Down=SHIFT–ENTER (Once)
for proper pilot's eye view.

TAKEOFF
Trim=58.
Propellers to High RPM--2700 RPM.
Start timer.
Release parking brake.
Throttles smoothly to 48 in M.P.
Rotate at 84 kts.
(Single-engine Control Speed)
Raise Gear.

CLIMB
M.P.=36 in.
2350 RPM.
105 kts. IAS.
700 fpm.

CRUISE
Level off at altitude, then adj. power.
M.P.=30 in.
2050 RPM.

DESCEND
M.P.=18 in.
1700 RPM.
125 kts. IAS.
500 fpm max.
Set Nav receivers as necessary
for the final approach.

APPROACH
3000 ft AGL.
Drop one notch of flaps-Max. 139 kts.
1700 RPM.
M.P.=21 in.
Slow to 105 kts.
500 fpm.

FINAL APPROACH
Gear Down.
Full Flaps.
Prop to High RPM.
Throttle to 2500 RPM.
Slow to 85 kts.
Hold 500 fpm or Glideslope
with throttles.

LANDING
Full Flaps.
Descend at 100 to 200 fpm.
80 kts. over the fence.
Bleed speed off to 75 kts.
Level Attitude for Main-Gear landing.
Cut Throttles.
Brake ONLY after tail settles on runway.

SLOWFLIGHT
1500 ft altitude AGL.
Flaps up.
1800 RPM.
21 in. M.P.
105 kts. IAS.
Gear stays up.

GO-AROUND
Full Throttle
Bleed flaps off to 1/4.
Gear Up on positive rate of climb.
Climb to 1500 ft. AGL.
105 kts. IAS.
Go to Slow-flight Config.