Arizona Type Ratings
Flying the Citation

So, what is it like to fly a Citation? Much of the basic skill required to fly any airplane is directly transferable to the Citation. I will assume that the reader is already a pilot with an airplane class rating. We will present some general flying information here, but the primary purpose of this chapter is to discuss the transition from propeller driven airplanes to the Citation. We will try to take what the student already knows from previous flying experiences and identify differences and similarities. Fortunately, there are lot more similarities than differences. The basics are the same. Here are a few "Citation specific" characteristics.

One Citation characteristic typical of most jet equipment is apparent shortly after engine start and that is residual thrust. All Citations except the very latest Encores have mechanical fuel controllers. Most Citations with mechanical fuel controllers have only one idle speed, and that is "Flight Idle". That engine speed is a little higher than the ideal ground idle speed would be. Flight idle must be set high enough to allow good engine acceleration in flight. This permits reasonably quick engine response during the approach and landing phase of flight. As a result of this high idle speed, the airplane likes to roll after engine start. The practice of setting the parking brakes before engine start is a good practice on any airplane and is included on most "Before Start" checklists I have seen. On the Citation, setting the parking before starting engines is even more important than on a propeller driven airplane because the airplane can easily roll undetected if brakes are not properly set. With a "heads down" crew after starting, the airplane can do some serious damage if allowed to roll unattended. Pedestal mounted flight management systems invite the crew to bury their heads in the cockpit shortly after starting engines. If you feel that need, just be sure the brakes are firmly set. In addition to the airplane wanting to roll after engine start, it also requires more brakes during taxi than many pilots making the transition are comfortable using. You do have to use more brakes while taxiing a jet to prevent the airplane from rolling faster than you might prefer. Do not let the airplane dictate taxi speed to you. Slow it down to a taxi speed you are comfortable with.

The appearance of the ground idle "HIGH / NORM" switch on the Citation V and Bravo allows the crew to reduce idle rpm significantly by selecting the "NORM" position shortly after starting the second engine. These Citations automatically idle at the higher rpm when airborne, preventing engines from spooling down to an unacceptable idle speed while in flight. Selecting "NORM" position on the ground reduces engine idle speed and therefore minimizes braking on the ground. Electronic fuel controllers on the Encore+ further diminish undesirable residual thrust.

A second characteristic the typical transitioning pilot might be unaccustomed to is the amount of thrust-lever movement required. Thrust levers on the Citation must be moved significantly to effect a change of airspeed. Many transitioning pilots are coming from piston twins or turboprops. Skilled pilots advancing from these airplanes are accustomed to making very small, precise changes in thrust. Significant thrust lever movement of propeller driven airplanes results in uncomfortable jerks of acceleration and deceleration at the very least. In addition, if the airplane involved has turbocharged piston engines, power must be reduced in small increments to avoid cylinder damage. In the Citation, thrust levers may frequently be reduced to flight idle and then advance back to cruise thrust several seconds later. Unheard of in most prop airplanes but commonplace in straight wing jets. Need to slow down significantly? Pull thrust levers to idle. Need to come down 4 or 5000 feet per minute to make a crossing restriction while keeping speed under control? Flight idle and sometimes speed brakes as well may be required. Don't be bashful about moving trust levers on the Citation whether retarding or advancing thrust. It is a new habit pattern that must be learned by the transitioning pilot.

Our next characteristic is somewhat related to the above paragraph and that is airspeed trend. Modest movement of thrust levers in the Citation results in a very gradual airspeed change. We frequently perform step-downs on non-precision approaches at flight idle to prevent accelerating unacceptably in the descent. After leveling off, it is important to advance throttles back to the desired power setting. If you don't, the Citation will very gradually slow to an unacceptable airspeed. The trend is so gradual that it may be imperceptible to the new Citation pilot. It is valuable to know not only what the current airspeed is but also what the airspeed "trend" is. In other words, what has airspeed been doing for the last minute or so? Tactile cues to airspeed learned in propeller driven airplanes are not present in the Citation. The typical pilot of a propeller driven aircraft can frequently sense speed by sound and feel. The Citation doesn't sound or feel much differently at 250 knots than it does at 150 knots. Modern noise canceling headsets in many cockpits serve to further mask sound as an indicator of airspeed. The airspeed indicator may need to become much more prevalent in your instrument scan. It helps you see trends which may result in an unsafe or at least an undesirable airspeed in the near future. Fix it before it becomes unsafe.

Our next characteristic that may be puzzling to the transitioning pilot is the absence or near-absence of pitch change with thrust change. Changing thrust on aircraft with propellers frequently results in significant pitch change. Adding thrust usually causes the nose to pitch up, resulting in a climb. Reducing thrust frequently results in a pitch down, resulting in a descent. In the Citation, adding thrust simply causes the airplane to accelerate. Retarding thrust simply slows the aircraft. Sounds pretty basic, but you can't imagine how many times I have seen a student try to fix a "below glide slope" error by adding power. As a result of the added thrust, we are now further below glide slope and have a new problem. We are now also too fast. If the airplane is above glide slope or visual glide path, the solution is to pitch down. If the aircraft is below electronic or visual glide path, pitch up. While flying Citations, control glide path with pitch. And control airspeed with thrust, period. This is true of many other aircraft as well. It can be argued that this energy management process is the correct way to fly all airplanes. I know it works in all airplanes I have ever flown. Avoid the "little airplane " practice of using power to control altitude.

If this explanation makes some aeronautical engineers cringe, I apologize. It is meant to be very basic. To explain briefly, pitch changes resulting from throttle movement can be triggered by a number of factors. Propellers literally screw their way through the air during stabilized flight, producing very little slip and therefore little prop-wash. When thrust is increased however, a column of air is accelerated aft from the propellers across the wing and frequently across the horizontal stabilizer. The horizontal stabilizer is an inverted airfoil and consequently produces a tail down force, or negative lift. If airflow over the tail is increased, the tail pitches down causing the nose to pitch up and the airplane climbs. This effect will continue until stabilized flight returns, or in other words until the airplane stops accelerating, stops climbing or until power is reduced. As a result, many pilots have observed or been taught that increasing power will immediately cause an airplane to climb and reducing power will cause an airplane to descend. Flight instructors of the world, please don't teach your students to fly this way. It is a disservice to students to teach them to control altitude with power. Even in small trainers, please teach them to pitch up to climb. It may be necessary to add power to maintain the desired performance during the climb and that's OK. That power is added to counter or prevent a decay in airspeed, not to change altitude. If they learn it wrong, it can be very difficult to unlearn. This is especially critical to students enrolled in career pilot programs that do not want to earn a living flying Skyhawks or Cherokees for the rest of their careers. Airplanes they are likely to fly in their careers are not flown that way.

This explanation does assume that thrust is available and variable, in other words engines are running and thrust levers are not already at "flight idle" or takeoff thrust. Granted, if there is no thrust available or if thrust is fixed, speed must be controlled by pitch. Examples of this latter operating scenario are initial climbout or any maximum performance climb. Since no more thrust is available in this flight condition, the only way to accelerate the airplane is to lower the nose. During most operations however, thrust is both available and variable. Therefore, speed should usually be controlled with thrust.

Another Citation characteristic to be aware of is spool up time. As jets go, Citation engines spool up reasonably quickly. However, they respond much more slowly than piston or turboprop engines do. Anticipate your current energy status and try to maintain adequate energy at all times. The energy we are referring to here could be in the form of thrust, momentum, airspeed or altitude. Try to avoid operating near the ground with engines unspooled until you are committed to land.

Typically, thrust may be gradually reduced to idle crossing the threshold after landing is assured. Reducing thrust to idle in the air may be unfamiliar to pilots of some propeller driven airplanes as well as pilots of many swept wing jets. It is a learned procedure which minimizes floating down the runway. The long straight wing on the Citation can float quite a ways. It is important to cross the threshold at ref but no more than ref plus 10 knots adjusted for gust factor and get rid of as much thrust as possible to minimize float. Statistically, we run more Citations off the end of the runway due to excessive speed than come up short due to inadequate airspeed.

This last Citation characteristic we will discuss manifests itself primarily while being vectored by ATC. Many pilots transitioning to the Citation are experiencing their first jet. They are accustomed to banking the airplane 15 or at most 20 degrees. Many commercial piston operators instruct their pilots not to exceed 15 degrees of bank with customers on board to prevent scaring them. That bank angle will not work in the Citation. Plan on a 30 degree bank for a standard rate turn. Flight directors on the Citation will command a 28 to 30 degree bank angle for all but the very shallowest of turns. Limiting bank angle to 15 or even 20 degrees will result in such a wide turning radius that you will frequently need another vector from ATC to put the airplane where the controller needs it.

Next, let's discuss an actual flight from beginning to end. We will call this your first training flight. Since you may be sitting in this equipment for the first time, do not be surprised if you spend more time during your first flight sitting on the ground than you spend actually flying. This is normal and desirable.

The factory checklist is an all-encompassing document written I am sure with input from an assembly of technical writers, attorneys, management personnel and hopefully a few pilots had some input. The document is very long, repetitive and frequently organized in a somewhat puzzling fashion. I am sure attempts have been made to organize the checklist into a flow, but those attempts have been only partially successful. I have several checklists written by different entities here with me as I am writing this and there is some variation in terminology but in general, they do follow a similar pattern. Whether written by Cessna, Flight Safety, SimuFlite, Simcom, Sierra or this author, someone's idea of a logical order of events is presented which will hopefully prevent us pilots from missing something important before taking off or landing.

Many Citation checklists will begin with a cursory exterior check to at least determine that the battery is connected and engine covers are removed. If this step is missing, it is implied. There is no way to perform the next step, the preliminary cockpit check without connecting the battery, so sooner or later that item will be done. Next you will likely be instructed to check the position of numerous switches, levers and indicators. A logical next step would be to select the battery switch to the "BAT" position. This allows us to check that battery volts are adequate, the pitot system is heating, exterior lights are operational and fuel level is adequate for the planned flight. Remember the two-minute limitation on pitot heat on the ground. The pitot heat should be turned on for 15 to 20 seconds and then selected off while the exterior light check is performed. Heated surfaces should be checked for warmth and exterior lights should be checked operational. Afterwards, the battery switch should be selected to "OFF" while the full walk around is performed. This exterior inspection typically starts ahead of the cabin door and proceeds clockwise around the aircraft. There could be up to a hundred or so items to check on the walk around so we will not go into that level of detail here. Just follow the checklist.

Since this is your first Citation flight, we may actually use our "Checklist" as a "Do-list". This is frequently the case if you are unfamiliar with the airplane involved. As your familiarity with the airplane improves, you should be able to "do and then check" instead of "read and then do". Then the document you are holding truly becomes a checklist instead of a do-list.

After the exterior check is complete, we return to the cabin for a cabin inspection and passenger briefing and then up to the cockpit. Though terminology will vary, a logical order of events should be presented by your checklist. Typically, there will be a "Before Start", "Engine Start" and "After Start" checklist. Sometime the "After Start" is replaced with a "Before Taxi" checklist. These variations in terminology are frequent, but the end result is the same. There is little to be gained here by dissecting the checklist in detail, just follow it.

Eventually, the full checklist may become adequately repetitive and redundant to you that you decide to construct your own. Operators with significant experience in the airplane frequently create a "Cold Start" checklist for the first start of the day and a separate "Quick Turn" checklist for subsequent flights. Sometimes a "Taxi-Back" checklist for training flights may be constructed where multiple takeoffs and landings may be performed before the flight is terminated. Constructing a checklist can be a very educational and thought provoking process to go through and will increase your knowledge of the airplane. For now, we will consider ourselves to be novices and will continue to follow the full factory checklist.

Seated back up front, now would be a great time to determine and record some takeoff numbers before we start burning Jet fuel while going nowhere. This airplane is frequently the first the student has flown where takeoff V-speeds are determined. FAR Part 25 defines these numbers in detail but a few deserve a brief review. We will first look them up and record them on our "TOLD" (short for "Take Off & Landing Data") card. These numbers are then set in the airspeed indicators. How and where they are set depends on the vintage of avionics installed in the airplane. If the airplane is equipped with conventional steam gauges, V1 will typically be set on the side of the non-flying pilot, in this case the right side where your instructor is sitting. He or she will therefore call V1 for you. V2 will typically be set on the student's side. On later glass panels, all numbers appear on both sides. For our training flight, we are assuming the school's 501SP with conventional airspeed indicators is being used.

These V-speeds, takeoff power and runway length required can be found in abbreviated form in the "Performance" section of most checklists or in the Flight Manual in unabbreviated form. First, we will review V speeds.

V1 is the takeoff commitment speed, the speed after which we are committed to fly. After V1, the vehicle we are in has become a very poor ground vehicle. Braking is poor and directional control is poor, especially if any crosswind exists. Enough lift is being produced that the airplane functions better in the air than on the ground. At this speed, the student's right hand is removed from the thrust levers because we are going flying. ANYTHING YOU DO TO THE THRUST LEVERS IMMEDIATELY AFTER V1 WILL BE WRONG. We are not aborting the takeoff after V1 and we have already set takeoff thrust so no additional thrust is available. Removing the right hand from the thrust levers removes the temptation to adjust thrust after V1. It also helps the student mentally adjust from a "stop" mindset to a "fly" mindset.

Vr is our "Rotate" speed, or more appropriately our "minimum acceptable" rotate speed. Published takeoff distance is predicated on rotating precisely at Vr. The airplane will perform as documented if rotated at Vr. However, the airplane will perform better than documented in all areas except takeoff distance if rotated "after" Vr. So if you are runway length critical, you should rotate at Vr. If you have lots of runway available as is usually the case, rotate a few knots after Vr. Rotating a little late will dramatically improve airborne performance. There is a technical limit to how fast is acceptable, that being limiting main tire ground speed of 165 knots. Realistically, rotating gently at Vr plus 10 to 15 knots is a reasonable "long runway" procedure.

The next V-speed of interest is V2. V2 is similar to best angle of climb with one engine inoperative. V2 is of interest to us only in the unlikely event of an engine failure after V1. V2 is our target "one engine inoperative" climb-out speed. This speed can be exceeded by 10 knots or so with almost no measurable decay in vertical performance, so V2 to V2+10 is our desired climbout speed with one engine inoperative. V2 is bugged on the airspeed indicator of the pilot flying, in our case the left side where the student is sitting. With both engines operating, V2 is exceeded by a significant margin during climbout. V2 is typically in the low 100s whereas a normal all engine operating climbout could range between 150 and 200 knots. So V2 is of consequence to us only in the unlikely event of an engine failure after V1.

Though engine failures are rare in everyday flying, they are quite common in the type rating business. About half of your takeoffs during training will involve some type of an engine problem. In the event of an engine failure, V2 to V2+10 should ideally be flown to at least 400 feet AGL, maybe higher if performance is adequate. The "Engine Failure After V1" checklist as well as the flight director command bars suggest a 7 to 8 degree "initial" body angle on a 501SP to assure the airplane will both lift off and will accelerate. Command bars on Citations with better performance will command a greater nose up attitude.

Since this 7 to 8 degree initial body angle will accelerate a 501 to V2, it will also accelerate the airplane through V2 as well. After reaching V2, body angle may be gently increased, typically up to 10 degrees or so to stay within 10 knots of V2 on climbout. However, limit the body angle so as not to decelerate the aircraft during climbout with an engine inoperative. Do not intentionally give up energy in the form of airspeed if the airplane is climbing out satisfactorily with an inoperative engine. If you rotated late and are climbing out at V2+20 and climb performance is satisfactory, I suggest you maintain V2+20 knots.

The final departure airspeed we will record on our TOLD card is Venr or Vyse, best rate of climb with one engine inoperative. This number will vary with weight and ranges from 130 knots or so in the small Citation at light weights to 160 knots plus for a heavy Citation V. If this airplane were a light twin, Vyse would be identified by a blue line on the airspeed indicator. Venr is simply blue line corrected for weight. After accelerating to V2+10 knots above 400 feet AGL, flaps may safely be retracted and we typically accelerate to Venr in level flight before resuming the final climb at Venr. As described in FAR Part 25, takeoff performance is predicated on these numbers being flown.

In addition to the departure speeds above, there is at least one arrival speed you should record, that is the emergency return Vref. Vref, short for "reference velocity' is equal to 1.3 times the stall speed in landing configuration under a 1G load factor. In the event an unplanned return to the airport becomes necessary, it is good idea to have considered what speed to fly. These things happen rarely but conditions that warrant an emergency return to the airport could be very demanding. You might be a little too busy to pull out a chart and look it up while you are trying to keep an airplane right side up. Look up and record that number before takeoff just in case things don't go as planned.

For more details on V-speeds, the 100 section of FAR Part 25, labeled "Performance" is a good reference source.

Now that the before takeoff paperwork is done, we can start engines without wasting precious jet fuel. Appropriate checklists such as "After Start", "Taxi" and "Before Takeoff" can be accomplished pretty much as published. While taxiing out, remember our comment about residual thrust and taxi speed. Don't let the airplane dictate taxi speed to you, you control taxi speed with brakes. You may have to use more brakes than you are accustomed to using. It is generally kinder to the brakes if you let speed build up to a maximum acceptable level and then brake down to a brisk walk. Release the brakes again and let speed build back up etc. This gives the brakes a little cool down time between applications.

Some items on the "Taxi Checklist" may be distracting to a pilot new to the Citation. If these items distract you from taxiing the airplane, ask your copilot to suspend the checklist until you stop the airplane at the hold short line. We do prefer to perform the "Thrust Reverse Emergency Stow" check while rolling if at all possible. Doing that check static tends to scoop exhaust gasses into the cockpit through the engine intakes. Performing that check during a brisk taxi will usually minimize that discomfort. You have to remember that while most pilots like the smell of burned jet fuel, most passengers don't. Most other "Taxi" checklist items can be done just as well or perhaps more easily setting at the end of the runway as rolling down the taxiway.

One of these checklists may mention the "Crew Briefing". Since this airplane may be your first exposure to crew operation, a little discussion on the crew concept is in order. Having a copilot to help out is a luxury many first-time jet pilots have never experienced. That person in the right seat is there to help you in any way possible. Today, that person happens to be the instructor and as such will fill the role of a teacher as well as your assistant. By the way, get used to being called "Captain". In order to get type rated in this airplane, you will need to act and perform like the captain. A good captain utilizes all resources available, and one of those resources is your copilot. Calling on the copilot for things you have historically done yourself does take a little getting used to. However, it can dramatically reduce your workload and right now, reducing workload is important. We have all heard the somewhat overused "drinking from a fire hose" analogy, but that is what a type rating is like. Having a copilot to help carry that load is huge.

In order to effectively use that asset in the right seat, clear concise communication between the two of you is essential. An important part of that exchange is the “crew briefing” which should be accomplished shortly before takeoff. I don’t think there is necessarily any one right briefing but some items should definitely be covered. A few thoughts are listed here for you to consider. This is just an example and by no means covers all the bases, but it gives you an idea of what bases to cover.

	Typical brief from captain
Who is flying	This will be a left seat takeoff
Set power	Set 93.9% Fan on takeoff
Call outs	Call “airspeed alive”, “70kts crosscheck”, “V1” & “Rotate”. Call “positive rate” and “V2+10”. Retract gear & flaps on my command
Abnormals/ Emergencies	Any abnormal prior to V1, we will abort the takeoff. (review V speeds) You notify tower Any abnormal after V1 will be treated as an in flight emergency. This will be our emergency return airport.
If all is well	Otherwise, our departure will be - - - - -etc

You may want to reiterate who tunes & identifies radios, talks to ATC etc. This is usually understood to be a copilot duty.

By now we should be holding short at the end of the runway with brakes set and checklist complete. Your first training flight is about to begin. It’s unlikely that any competent instructor would create an abnormal on your first takeoff so relax, it’s just another airplane. After being cleared for takeoff you call for the runway items sometimes referred to as “hot” items, check that final is clear as you would in any other airplane, release the parking brakes and add a little thrust to start rolling onto the runway. As you line up with the centerline, stand the throttles up to roughly vertical and command "Set Takeoff Power". Move your heels to the floor, clearing the brakes so you do not unintentionally drag a brake on takeoff. For all practical purposes, you should never steer the airplane on the takeoff roll with differential braking. Your copilot should have takeoff power set within a few seconds and the throttles are yours again. Steer using nosewheel steering through the rudder pedals as you would in any other Cessna. The airplane will accelerate a little more briskly than you might be accustomed to, but nothing drastic. You will hopefully hear the "airspeed alive, 70 knots crosscheck" calls you asked for in your crew briefing. Then comes "V1" and almost immediately afterwards "rotate". In response to the V1 call, your right hand should leave the throttles and move to the control yoke. At the "rotate" call, gently pitch the nose up about 10 degrees in one steady motion. It should be done gently without a pause or relaxation of back pressure. The full rotation should comfortably take 2 or 3 seconds. After the positive rate call from the instructor, command "Gear up". Several seconds later, you will hear "V2 + 10" letting you know that airspeed has increased adequately to safely permit flap retraction. You should respond with "Flaps Up". If it's a bumpy day, your future passengers would appreciate the yaw dampner as soon as practical after takeoff. Your copilot will engage the yaw dampner at your command. Airspeed is probably approaching 150 knots or so and rate of climb is steadily increasing through 1000 feet per minute and could easily exceed a couple thousand feet per minute by pattern altitude. Personally, I suggest that you do not reduce thrust or deal with the After Takeoff Checklist until 1500 feet AGL. Nothing in that checklist is important enough to allow a distraction to occur that close to the ground.

We have been in the air now less than a minute and are climbing through 1500 feet AGL. Takeoff power is permitted for 5 minutes but since this is a training flight we are not going to continue our climb to altitude. Takeoff power is going to get us in airspeed trouble real quick as we level off. Better get the thrust levers back to a more leisurely power setting. For this training flight, I would suggest about 450 pounds per side fuel flow. That is a significant reduction from the 1200 pounds per side we were burning at takeoff thrust. The act of pulling power back that much to prevent an airspeed problem may seem foreign to most light plane pilots but it's business as usual in the jet arena. By the way, we are frequently operating under Phoenix Class Bravo airspace and consequently we are subject to the 200 knot speed limit. That 450 pounds per side fuel flow will stabilize us at about 170 knots.

You can expect to depart Scottsdale to the east and we will work our way up to maneuvering altitude as traffic to Sky Harbor and Phoenix TRACON allow. We do most of our airwork between 6000 and 7000 feet AGL to the east and southeast of the Phoenix Class Bravo airspace. The following is a summary of the maneuvers required by the ATP and Aircraft Type Rating Practical Test Standards. These tasks constitute the checkride so they are the tasks we will rehearse during our training flight. The order is obviously arbitrary and subject to change.

We will begin airwork today with our stall series. The type rating is conducted to ATP standards and stalls at the ATP level are eminent stalls. We will therefore recover from these stalls at the first indication. If the aircraft being used has a stick shaker, that indication is adequate. Any burble or mushiness of controls will also suffice. Having observed a few thousand of these, a very helpful indicator is angle of attack. If the AOA is approaching the red arc or .85 or higher, the stall is eminent and you just haven't noticed it yet. Very shortly a real stall will occur so you would be well advised to start the recovery. We are required to demonstrate three stalls, one in the cruise configuration, one in the takeoff and approach configuration and one in the landing configuration. These stalls are all constant altitude maneuvers. Two of them are constant heading maneuvers and one, the turning stall is a constant bank angle maneuver. A great deal of airmanship is being displayed during these maneuvers. The student is asked to hold an altitude and heading (or bank) precisely while the aircraft slows from 200 knots or so down to well below 100 knots. The student then must recognize arriving at minimum flying speed, reconfigure as required and accelerate out all the while holding that altitude and heading.

Remember our discussion on being unspooled? The slower the engine is idling, the longer it takes to spool up. It is in the student's best interest to keep engines turning as fast as possible and still demonstrate the stall. Through experimentation, we have determined that an acceptable residual power setting is about 200 pounds per side fuel flow for the "clean" and "takeoff & approach" configured stalls. We will begin by setting that fuel flow and patiently wait. This could take a few minutes and that's OK. While we are waiting for speed to bleed off, we have an abbreviated "stall" checklist that we suggest. It's sometimes referred to as the ICEY check. I for Ignitors "ON", C for Computations (bug Vref.), E for Engine sync "OFF" and Y for Yaw dampner "OFF". As the airplane slows, the pilot must constantly pitch up in one or two degree increments to maintain the adequate lift to prevent a descent. Nose up trim is suggested to about 140 knots. Below 140 knots, we suggest you hold altitude with back pressure alone. This prevents severe nose-up forces during recovery. This speed, 140 knots is sometimes referred to as a "stop trim" speed.

As we learned in basic aerodynamics, airplanes stall based on angle of attack, not airspeed. Assuming a one "G" load factor, the body angle that results in that critical angle of attack is between 10 and 12 degrees. The technique we suggest to recover from an eminent clean stall is to simultaneously add thrust and reconfigure the wing to a higher lift configuration, or Flaps 15. No reduction in body angle is required if the recovery is initiated promptly. Remember that this is a constant altitude maneuver and lowering the nose would result in an unnecessary descent. The nose is lowered only after the recovery is well under way and then only to prevent the aircraft from climbing. The pilot should advance thrust levers to the stops and retard them a half-inch or so and simultaneously call "MAX POWER, FLAPS 15". The instructor will respond to those calls by selecting Flaps to the approach or 15 degree position and adjusting thrust to maximum power permitted. Flaps will arrive at the 15 degree position in less than two seconds, effecting an 8 to 10 knot reduction in stall speed long before engines can accelerate the airplane significantly. As airspeed increases past ref+10 knots, flaps can be safely retracted. Recall that we stopped trimming the nose up at 140 knots. As we accelerate through 140 knots it will be necessary to begin trimming nose down to neutralize pitch forces during acceleration. The maneuver is considered over at 170 knots or so. Some operators are no longer suggesting approach flaps during the clean stall recovery and I understand the logic, especially in the case of an SII or a V with hydraulic flaps. It will take 8 seconds or so for hydraulic flaps to arrive at their approach setting. If that amount of time has already lapsed, the recovery is well underway or perhaps over. Flaps are a much more effective recovery tool on Citations with electric flaps, specifically the CE-500s and CE-550s. At Arizona Type Ratings however, we still prefer to use of approach flaps in the clean stall recovery even though they are a little slow.

Our next stall to be demonstrated is the turning stall with flaps set at “takeoff & approach” or typically 15 degrees. The setup is the same, fuel flow to 200 pounds per side, ICEY check completed. Assuming airspeed is below 202 knots, flaps may be selected to 15 degrees and as airspeed drops below 176 knots gear may be selected down if desired. A 20 degree bank turn is commenced and altitude is maintained with back pressure and trim to 140 knots. As before, we stop trimming at 140 knots and hold altitude with back pressure alone to the first indication of a stall. An angle of attack of .85 should coincide with a body angle of 12 degrees or so. When the stall is eminent, recovery is similar to the clean stall, max power, hold the pitch attitude, roll wings level and accelerate out. Flaps were already set at approach but can be confirmed if the student so desires. Lower the nose only after recovery is well underway and then only as necessary to prevent the aircraft from climbing. If lowered, the gear can be retracted at any time and accelerating through ref + 10, flaps may be retracted. Consider the maneuver complete at 170 knots.

The landing configuration stall is a little busier. A few paragraphs back we said that it’s in the student’s best interest to leave in as much residual thrust as possible and still demonstrate the stall. This stall will be demonstrated in landing configuration, flaps to "LAND" and gear "DOWN". With that much drag hanging out, we can leave quite a bit of power in and still slow the airplane to a stall. We suggest around 400 pounds per side fuel flow. The airplane will initially be configured to flaps 15 once below 202 knots. Gear may be extended below 176 knots and then flaps selected to "LAND" only after all three gear are down and locked. These configuration changes will be made by the copilot/instructor at the captain's command. As in the other two stalls, I suggest you stop trimming the nose up at 140 knots and hold altitude with back pressure alone below that speed. As the nose is pitched up to maintain altitude, a .85 AOA and a 12 degree body angle will coincide to signal an eminent stall and the recovery should be initiated. In this recovery, it's important to realize that the wing is currently "flying on flaps". If the flaps were not selected to the "LAND" position, the wing would have quit flying 15 to 20 knots ago. Flap retraction will actually raise the stall speed. Consequently, it's desirable to allow speed to increase at least 10 to 15 knots before retracting flaps. This will ensure the wing continues to fly throughout the recovery. So this recovery consists of simply adding and calling for "MAX POWER" and patiently waiting for the resultant acceleration. Body angle should initially be maintained at 12 degrees or so until the airplane begins to climb. Only then should pitch be reduced as necessary to prevent the climb. As airspeed approaches Vref, flaps may be retracted to 15 degrees, gear may then be retracted and by now airspeed has increased to well beyond Vref + 10 and the remaining flaps can safely be retracted. These airspeed increases will be called out by your instructor and you should command flap and gear retraction in response to those calls as airspeed increases adequately. Accelerating through 140 knots, nose down trim will be necessary to neutralize pitch up forces. As before, this maneuver should be considered complete as airspeed increases through 170 knots.

The next maneuver to be trained today is the steep turn. The ATP and Aircraft Type Rating Practical Test Standards require that steep turns be demonstrated with a bank angle of 45 to 60° with a tolerance of +/- 5° in bank. The ADI on the Citation has two triangles that line up nicely at 45°

so that bank angle is typically used. Airspeed is at the discretion of the examiner, typically 200 knots with a 10 knot tolerance. Altitude tolerance is +/- 100 feet and roll out tolerance is 10°. The power setting we suggest for steep turns is 550 pounds per side fuel flow, a little less if you're light and a little more if you're heavy. This power setting is relatively constant at a wide range of altitudes and is useful for all Citations powered by JT15D power plants.

Approximately 2 to 3 degrees of pitch up will be required to replace the vertical component of lift lost in a 45° bank. Take care not to pitch up until your bank angle approaches 45° or the airplane could climb through your 100-foot tolerance. Unfortunately, left and right steep turns may not always appear identical on the ADI in the cockpit due to the pilots viewing angle and precession in the mechanical gyros installed in a large majority of the fleet. Your pitch up angle and roll out rate could differ between a left steep turn and a right steep turn. So we typically practice a few in both directions. Most of the information required for an accurate steep turn is presented by the captain's ADI with altimeter, airspeed indicator and heading indicator as support instruments. Steep turns may be demonstrated as 180° or 360° turns.

Next we will train a few unusual attitude recoveries. We will train both nose-high and nose-low unusual attitude recoveries with some in a bank and some in wings level attitude. Nose-low scenarios are frequently accompanied by extreme acceleration and nose high scenarios are usually accompanied by decaying airspeed. Since the Citation is not aerobatic and we are not wearing chutes, these maneuvers will appear mild when compared to maneuvers flown in aerobatic or military aircraft. These recovery techniques assume the aircraft is not inverted.

Under simulated instrument conditions, it can be more difficult than you might think to quickly determine the aircraft's pitch attitude. The captain's ADI is primary for this maneuver. If you see mostly or all blue on the ADI, your attitude is extremely nose high and airspeed will shortly decay to lower than desired. In most cases, thrust should be increased to prevent a stall. A stall is somewhat undesirable, but unlike extreme airspeed, you will not overstress an airframe during a stall. With an all blue ADI, the next chore is to find the horizon. It is undesirable to simply push the nose over while in a nose high attitude. This is rough on the airframe and unpleasant on occupants of the airplane. Things and passengers in the back can be thrown about in the cabin and someone could easily be injured. It's best to recover the airplane as gently as possible. Rolling the aircraft with ailerons is an effective way to put the nose on the horizon while subjecting the aircraft to minimum "G" forces. Airframes are almost always constructed to tolerate more positive G's than negative.

There may be chevrons painted on the ADI that point to the horizon on some later Citations. Many of us had never seen these chevrons until we began performing these recoveries. They are well out of view until pitch attitude exceeds 50° above or below the horizon. These chevrons point to the horizon. Knowing where the horizon is can be crucial to a safe recovery from an unusual attitude. In summary, in a nose high, banked unusual attitude, our desire is to exaggerate the bank angle, allowing the nose to fall to the horizon with little or no forward pressure on the yoke. Once the nose is on or near the horizon, wings can be leveled with little stress on the airframe.

A wings level nose high attitude should be recovered from by adding power as required and then intentionally rolling into a significant bank. This order of recovery will coax the nose to the horizon without unloading the airframe or unseating occupants in the rear. As before, once the nose is on the horizon, level your wings. Rolling motion produces very little load on the airframe. It's the pulling and pushing of the elevator that can induce significant airframe loads. These pitch inputs should be performed with care. Should an inadvertent spin result during a real life jet upset, normal spin recovery techniques would apply. Power should be reduced to idle, relax back pressure, level the wings and apply rudder opposite the direction of rotation. Should a spin occur during training, I would suggest taking a break from training, discuss what just happened and devise a plan to prevent it from happening again.

An unusual attitude where the ADI is all brown indicates a nose-low attitude. This time we must deal with potentially excessive airspeed by pulling thrust levers to idle and deploying speed brakes. If the chevrons are present on your ADI, use this information to locate the horizon and roll to a wings level and upright attitude. Most pilots consider the nose low recovery to be more logical than the nose high recovery. The process is logical but there is a greater danger of stressing the structure in the nose low scenario due to the potential of high airspeed. Be sure to get the power back and the boards out promptly in a nose low recovery. A nose low unusual attitude is more likely following an actual jet upset than a nose high unusual attitude.

Since we are at several thousand feet AGL and will be descending shortly, let's take this opportunity to shut down and restart an engine. There are no memory items on the "Securing Engine " or Single Engine Restart" checklists so we simply follow the checklist. At Arizona Type Ratings we follow the "Airline Transport Pilot and Aircraft Type Rating" Practical Test Standards and perform actual engine shutdowns and restarts in flight the same as we perform all other tasks in the standards. I am amazed that many type rating schools do not, some with the blessing of their Flight Standards District Offices. We do alter the order of some of the steps slightly to be kind to the engines. Checklists do vary, but in general they have you shut down the engine with the thrust levers and then secure the engine by selecting the effected generator switch to "OFF", selecting the effected ignition switch to "NORM" and selecting the effected fuel boost pump switch to "ON". This last step is suggested to keep the engine driven fuel pump lubricated. These pumps are gear style pumps and will not pull a suction. Instead, they will cavitate and begin to pump air bubbles if a positive head pressure is not maintained. As a result, the engine driven pump will suffer unnecessary wear while windmilling with the throttle at cutoff. This fact is of minor concern to an engine that may rarely be secured, as is typically the case. However, in the type rating business, engines are frequently shut down. Consequently, we choose to turn the associated fuel boost pump switch "ON" prior to pulling the throttle to cut-off. This maintains a positive head pressure at the fuel pump's intake while the engine is windmilling.

After securing an engine, the "Single Engine Restart" Checklist is followed as written. There are two procedures to choose from, a "starter assisted" start and a "windmilling" start. As its name implies, the starter assist start utilizes the starter to spin the accessory drive and therefore the N2 shaft. A windmilling start utilizes airflow through the engine due to forward velocity of the aircraft to spin the turbine. There will be a minimum airspeed published for a windmilling start, 200 kts. on the 501. 200 kts is the lowest airspeed that will spin the N2 shaft adequately fast to safely start the engine. In addition to airspeed, there is a maximum altitude specified, FL350 on the 501. Trying to perform an air restart above FL350 would likely result in a hot start due to the low air density above that altitude. Even though the outside air is very cold, it is so thin that it doesn't carry heat away well. This could results in unacceptably high internal temperatures during very high altitude starts. Actually, if you lost an engine above FL350, the airplane would immediately begin a drift down whether you like it or not. The Citation will not maintain FL350 with one engine inoperative.

With proper checklists followed, we have shut down and restarted an engine and are now ready to descend and commence approaches specified in the Practical Test Standards. Our last maneuver at altitude is an emergency descent, allegedly due to a pressurization problem of some kind. We choose to simulate an explosive or rapid decompression for this task. The "Rapid Decompression" checklist first addresses physiological needs of the crew and passengers, specifically oxygen masks. After physiological needs are satisfied, the "Emergency Descent" checklist gets the airplane on its way downhill. An emergency descent can be impressive and even a little scary to the student performing one for the first time. Thrust is reduced to flight idle, speed brakes extended and a bank is initiated to minimize negative load on the airframe as the nose is lowered for the descent. Some checklists suggest a specific nose down attitude and some do not specify. Typically, 15 to 20 degrees works well and results in a descent rate of between 10,000 and 15,000 feet per minute. Mechanical vertical speed indicators typically peg at 6000 feet per minute so the only way to determine descent rates so high is by timing the altitude loss. 15 to 20 degrees nose down may not sound like a lot but most students are hesitant to push the nose over that far. As pilots, we are accustomed to seeing some sky outside or at least some blue in the ADI. At 20 degrees nose down, all you see outside is dirt, trees and maybe cacti in Arizona. This is an unusual picture indeed but not a terribly traumatic event once you are accustomed to the attitude. The ride down is smooth with only mild buffeting created by speed brakes. Airspeed must be kept below the Vmo/Mmo redline. We conclude this event by gently leveling off, retracting speed brakes as the aircraft slows to a more reasonable airspeed and then adding thrust required to maintain that desired airspeed. During this descent, the airplane should be pointed towards a suitable airport.

With airwork behind us, we are being vectored for our first approach, which happens to be a coupled ILS with all engines operating. We suggest a target airspeed of 170 to 180 knots and suggest about 450 pounds per side fuel flow to accomplish this. 400 pounds may do if you are extremely light and it may take 500 pounds if you are heavy or it's bumpy and you prefer a little extra speed for gust factor correction. The approach briefing and appropriate checklists are accomplished and once we are established inbound and see the glide slope needle come off the peg, your instructor should call "glide slope alive". You respond with "flaps 15" and the instructor selects flaps to the "Takeoff & Approach" or 15° position. Next, your instructor should call "glide slope one dot" as the glide slope indicator moves to one dot above and you respond with "gear down, landing check". By "glide slope intercept" the landing check should be wrapped up, landing flaps selected and verified, ignition is confirmed "on" and eventually the yaw dampner is selected "off". Our 450 pound per side fuel flow will permit energy to bleed off as we track down a 3 degree glide slope and we should stabilize at Vref+10 to 20 knots. We might need to trim throttles back a bit as we approach our 200 foot "Decision Height" to put us within 10 knots of Vref. Today however, we will choose this approach to demonstrate a missed approach and the published procedure is accomplished.

The missed approach is initiated by simultaneously adding go-around power, pressing the TOGA (TakeOff GoAround) button on the left thrust lever and pitching to the two engine go around attitude. Calling "Max power, flaps 15" will command your copilot/instructor to adjust power to go-around thrust and select flaps to 15 degrees. Go around body angle is about 10 degrees in the Citation I, a few degrees steeper in the larger Citations. That body angle is the same as is typically used for rotation during a normal takeoff. Pitching up is very important. Many pilots making the "prop to jet" transition are accustomed to aircraft that pitch up on their own when power is increased. These pilots tend to add power but tend not to change the pitch attitude, causing the airplane to accelerate towards the ground instead of climbing out. This is not a good thing to do 200 feet above the runway. Well designed jets with tail mounted engines experience little if any pitch change with the application or reduction of thrust. Since this airplane does not pitch up noticeably with the application of thrust, consciously pitching up is an essential part of the missed approach or go-around procedure.

The "positive rate" call from your instructor is your cue to command "gear up" and the "Vref plus 10 " call prompts you to command "flaps up". The chore now at hand is to execute the missed approach procedure as briefed, in this case the published procedure. A lot is going to happen in the next two minutes or so. This segment of the approach leaves many transitioning pilots in the dust wondering "what just happened?" Though modest by jet standards, the Citation climbs and accelerates rapidly compared to most propeller driven airplanes. The combination of speed and climb rate frequently results in climbing through the holding altitude or getting well outside protected airspace while maneuvering into the holding pattern. Pay attention and keep the airspeed in the 170 knot range.

After establishing ourselves in the holding pattern, you might consider turning the airplane over to the instructor or at least to the autopilot. You and your instructor will begin discussing the next approach and that will require significant attention on your part. Again, utilizing the autopilot or your instructor as a first officer is an adjustment many pilots transitioning to a crew airplane have a problem with. Believe me, it is in your best interest to develop that skill when you begin to fly this class of airplane. This is not an exercise in machoism. We are developing the talent to utilize as many of the assets available to you as possible and that includes the autopilot and copilot.

One of the non-precision approaches to be demonstrated on your checkride tomorrow must be flown without the benefit of radar vectors or in other words, by way of your own navigation. Let's discuss that approach now. This approach will frequently include a procedure turn or holding pattern in lieu of a procedure turn. At the airports we use for training at Arizona Type Ratings, there are several choices of approaches to demonstrate these tasks. Remember that we are essentially rehearsing a checkride we will be taking within the next day or two.

Your instructor will select a non-precision approach for you to brief, set up and perform, preferably one that can be originated from your current position. When you are ready to proceed on the outbound leg, you will leave the hold and track a course outbound or proceed direct to some initial approach point in order to commence the approach. We must demonstrate two non-precision approaches on the flight check, one with a simulated flap failure and one terminating in a circle to land. This next approach will be executed with the "flaps inoperative" and by way of your own navigation.

When you are informed that the flaps are inoperative, simply call for the "abnormal landing, flaps inoperative" checklist. There are no memory items on this checklist so simply follow the instructions. In essence, Vref on 500 series Citations is adjusted up 20 knots and Vref on all other Citations is to be adjusted up 15 knots. The difference is due to the fact that slotted flaps are installed on 500 series Citations and not on the 550 and 560 series Citations. Slotted flaps are more effective so a larger speed penalty is added in when they do not work. I suggest you actually reposition the airspeed bug to the new Vref rather than just trying to remember the new number. Other than increasing Vref, the abnormal landing checklist is pretty much the same as the normal "before landing" checklist. Anticipate landing distance to increase by a factor of two or three times, though the checklist suggests a much smaller multiplier. Consequently, "no flap" landings should only be attempted at relatively long runways.

Training the student to fly an approach without the benefit of radar vectors helps to sharpen "positional awareness" skills. These skills are essential for all instrument flight, and especially so for instrument operations where there is no radar or limited radar coverage. The student will need to transition from the holding pattern onto a segment of the approach, track the course outbound if applicable, perform a procedure turn and rejoin the inbound leg, all based on his or her knowledge of current location as compared to desired location. Suggested target airspeed while maneuvering outbound is 170 knots. The minimum airspeed I like to see outside the final approach fix inbound is 150 knots. Power setting required to maintain this speed is about 450 pounds per side fuel flow in level flight.

In spite of your best efforts to keep speed under control, this approach may be flown a little faster than normal due to the lack of flaps, and early gear extension to help slow down is permitted and actually desirable. I suggest you perform step-downs at flight idle and target 1000 feet per minute descent rate. Within 5 miles or so of the final approach fix, flaps should normally be selected to approach. In the real world, this may actually be where you discover they do not work. When the flap or any other switch is moved in any airplane, take a few seconds to confirm the request you made by moving the switch was actually satisfied. In other words, don't move switches without verifying them. When the student calls "flaps approach", an appropriate response from the instructor would be “flaps selected approach” and then a few seconds later, ”flaps indicating approach”. Flaps arriving at approach can be verified by observing the flap position indicator on the pedestal visually or by feeling the indicator move into position with your finger. Unfortunately they will not work on this approach and the abnormal checklist mentioned previously is consulted and proper Vref adjustment is applied.

It is very helpful to keep airspeed and “angle of attack” information in your scan on all approaches. Unfortunately, “angle of attack”, or AOA as we will refer to it in the future, is mentioned sparingly in Cessna’s documentation. It is at the very least invaluable as a backup to airspeed and the AOA transmitter provides an indication corrected for flap configuration and load factor. It is important to precisely control airspeed in these step-downs and level offs. It is sort of like a ballet, power to idle during step-downs to prevent acceleration and then power back up as you level off to prevent deceleration. It is all about energy management.

As we transition into an era of more modern avionics with the ability to calculate an electronic glide slope using GPS and internal software, these step-downs will probably eventually be replaced with a constant rate descent as directed by the glide slope indicator just like an ILS. This will dramatically simplify energy management during descent on those approaches. We all should welcome and embrace these advances as they appear. However, as of this writing, we are not quite there yet so we will continue to teach non-precision approaches in the conventional manner with step downs.

The appropriate checklists have been accomplished and we are at the minimum descent altitude, “MDA” and looking for the airport. As you approach the missed approach point the airport appears out of the simulated clouds and a normal descent to land is commenced. As you are maneuvering to land, your instructor calls “Go Around”. You should now simultaneously advance thrust to “go around” power and pitch to a 10 degree body angle and call “max power, flaps fifteen”. Since you only had time to approximate “go around” power, your instructor will adjust power and he may or may not select flaps to "approach" or 15°, since they were being simulated as inoperative. You have just performed a "rejected landing" or a go around within 50 feet of the runway and another little box on your instructor's lesson plan is checked off. As your rejected landing turns into a missed approach, your instructor fails an engine. Check off one more box, the "one engine inoperative" missed approach. After climbing to a safe altitude with one engine inoperative, appropriate checklists are consulted and we are now on vectors for another ILS, this time single engine.

Though not a perfect match, the "Engine Failure During Coupled Approach" emergency checklist is the closest Citation 501 checklist Cessna publishes to cover our current scenario. Among other things, it calls for an increase of power as necessary on the operating engine and rudder trim as required. This trim requirement will keep changing as you climb out, level off and accelerate to your suggested target speed of 170 knots or so. If your leg is up to it, you can simplify things for yourself if you can keep the ball centered by holding rudder pressure until you have leveled off and reduced power to maintain your target speed. You will find it takes much less rudder trim in this stabilized condition than it does during a high power low speed climbout. Lots of asymmetric thrust coupled with a slow climb speed requires a great deal of rudder trim. Higher airspeed makes the horizontal stabilizer and rudder more effective. Lower asymmetric thrust reduces the need for rudder further. If you simply cannot keep the ball in the center in the climb with brute force, then by all means trim towards the operating engine. Be advised you will have to re-trim the rudder as airspeed stabilizes and power is reduced in level flight.

Once target airspeed and altitude are reached and the ball is centered with trim, your instructor may suggest you engage the autopilot. As long as no significant power setting or airspeed changes are made, the autopilot will fly a properly trimmed Citation with one engine inoperative quite nicely. Your other alternative would be to transfer controls while you look over the approach you are about to fly. Most often, you are preparing for a crew checkride. Not only are you permitted to use your first officer, you are expected to use him. The instructor may help you set up your navs for the approach or he may ask you to set it up yourself. You should not be recommended for a checkride unless you know how to tune and identify navaids and set the appropriate course. Do not try to fly the airplane, brief and set up for the approach simultaneously. Utilize your available assets, including the other crewmember and your autopilot.

The primary difference between the “one engine inoperative” ILS and normal ILS is that flaps are restricted to 15° until the runway is in sight AND landing is assured. As a result, your minimum speed is adjusted to Vref + 10 knots until such time landing flaps are selected. You will have more than adequate thrust with one engine operating to remain well above the minimum of Vref+10 knots. Your target speed to the final approach fix is 30 to 50 knots above this minimum speed. More common than getting too slow is getting too fast while descending down the glide slope with one engine inoperative. This is due to the low drag created by the Flaps 15 configuration.

Flaps should be selected to 15° at glide slope alive and gear selected down at one dot below glide slope just as is the case with the normal ILS. Power will have to be gradually reduced descending down the glide slope in order to decelerate to an acceptable airspeed. At the pilot’s discretion, flaps may be selected to “LAND” when landing is assured or left at 15° for the landing. If the landing is to be performed with flaps at 15°, Vref+10 knots should be maintained until in ground effect. This approach typically terminates in a full stop landing.

This may be a good time for you and your instructor to review tasks practiced so far and decide if any of them need a little brush-up. You will either taxi to parking and debrief or taxi back and continue training. Let’s assume both you and your instructor are happy with the training accomplished so far and you elect to continue.

Tasks not yet practiced include the rejected takeoff, engine failure after V1, known as the V1 cut and our last approach. The Practical Test Standards states that the rejected takeoff must be initiated at an airspeed of no more than 50% Vmc. The airspeed indicator on the Citation has barely come alive at this speed, so expect the rejected takeoff to occur at so low of and airspeed to be a non-event. Depending on runway remaining, a taxi back to the end may or may not be required after the abort.

Though not inherently unsafe, the V1 cut does seem to create a little anxiety on the part of some students. After participating in a few thousand of them, they seem pretty benign, or at least in the Citation they do. But the average student has never done one, so some concern is understandable. Surprisingly, some high time pilots with other type ratings have never performed a V1 cut in an actual airplane. The important things to remember are to keep your feet low on the rudder pedals so you don't inadvertently drag a brake, correct the yaw before rotating and then rotate slowly and gently to the "one engine inoperative" body angle suggested by your flight director command bars. Remember that rotating a little late will improve performance in all areas except takeoff distance. And if you have a lot more runway available than is required, holding the airplane on the ground beyond Vr will improve climb performance significantly, especially with one engine inoperative.

So let's give it a try. Just taxi onto the runway, point the nose straight down the centerline and smoothly advance thrust levers to near vertical and call "set takeoff power". Expect to hear the customary airspeed calls from your instructor, "airspeed alive, 70 knots crosscheck, V1" and "rotate". At the V1 call your right hand should be removed from the thrust levers and placed on the control yoke. NOTHING YOU DO TO THE THRUST LEVERS AFTER V1 WILL BE CORRECT. Any power changes after V1 will be wrong. We are now committed to fly so pulling trust to idle after V1 is unacceptable. We have already set takeoff power so no more thrust is available. Removing your right hand from the thrust levers eliminates the tendency to advance or retard thrust levers inappropriately. You should now be concentrating on tracking the centerline. Your instructor has pulled one thrust lever to idle and you will feel the airplane yaw to one side. Apply opposite rudder to stop the side drift and then only after stabilized, gently rotate to the flight director command bars. The aircraft should gently lift itself into the air and accelerate and climb out. Rotating too abruptly could cause the aircraft to lift off but not accelerate or climb out of ground effect. Rotating before directional control is re-established could point the airplane off to the side of the runway where no obstacle clearance is guaranteed. Remember those antennas and buildings you see between and adjacent to runways at airports?

The body angle commanded by your flight director should allow the airplane to both climb and accelerate to V2 with one engine inoperative. At the "positive rate" call, command "gear up". Gently pitch to maintain between V2 and V2+10 knots on climbout at least to 400 feet agl. However, let's say we rotated a little late as suggested and before we realized it we were at V2+20 knots airspeed. If the airplane is climbing satisfactorily, simply maintain V2+20 knots on the climbout. Do not pitch to a body angle that will decelerate the aircraft. The penalty you paid for your current airspeed is a longer than published takeoff distance. You apparently had runway to give and the result is the airplane is climbing better than expected. Don't give up your slight energy surplus by unnecessarily slowing the aircraft.

You might ask yourself "why am I flying off the runway with an engine inoperative and thousands of feet of pavement ahead of me?" Let me assure you, that question has been asked of me hundreds if not thousands of times. The answer is a little complex. At V1, the manufacturer has determined that the aircraft has transitioned from an easily controllable ground vehicle to an airplane. Enough lift is being produced to make the airplane a poor ground vehicle and a pretty easily controlled air vehicle. There is very little weight on the tires so braking action and directional control is poor. The aircraft is very susceptible to drifting sideways with any crosswind that may exist. Distance required to stop the airplane will certainly exceed published takeoff distance and finally energy required to stop the airplane could easily blow tires, overheat brakes or possibly blow the fuse plugs installed in the main wheels. Statistically, high-speed aborts are very dangerous and should not be attempted after V1.

We are now airborne, holding heading with lots of rudder and climbing out with wings level as close to V2 as possible. Other than the gear we retracted at positive rate, we are going to make no configuration change until at least 400 above the ground and depending on performance, we may not make any change until turbine pattern altitude of 1500 feet AGL is reached. We are also not going to deal with the emergency until a minimum safe altitude is reached. When you compare an engine problem in a jet to an engine problem in a light twin, it's apparent that there seems to be nothing to do in the jet. No "identify, verify and feather". No bank into the operating engine. As a matter of fact, any hastily taken action could very easily be disastrous. No performance change will occur when the failed engine is retarded and secured, so I strongly suggest you do not change or move anything until a minimum safe altitude has been reached and the flow of adrenalin is returned to normal. In their haste to "secure" a failed engine, I have seen many experienced pilots retard the wrong engine during climbout. It gets real quiet in the airplane or simulator when you do that.

Once minimum safe altitude has been reached, the nose should be gently lowered so we can accelerate to V2 + 10, minimum safe flap retraction airspeed. After flap retraction our target airspeed is Venr or Vyse, standing for **Venr**oute or best rate of climb speed single engine. Venr is similar to blue line in a light twin. After stabilizing at this safe altitude and airspeed, your instructor will probably declare the maneuver over and restore the engine.

The only remaining tasks to practice are our final approach, which happens to be a GPS approach, and a landing from a circle. As you recall we have already accomplished our abnormal landing with no flaps, so this last landing will be fully configured. Typically, Vref would be around 100 knots at typical training weight. I teach some airspeed adjustments to Vref as a function of configuration that are worth mentioning here. These adjustments are not regulatory, just my personal observations from doing this for a while.

Let's assume we look up Vref in the table for our current weight and see 100 knots. Remember that Vref is equal to 1.3 times the stall speed in landing configuration. It assumes a 1G load factor, in other words no banking or other activity that would load the wing beyond 1G. Prior to extending flaps, I would suggest a 20-knot penalty to Vref for an adjusted Vref of 120 knots. Remember, this was the same penalty we used for our landing earlier with inoperative flaps. In other words, each notch of flaps we are missing will result in a 10-knot increase in Vref. Vref with flaps set at approach equals a minimum safe speed of Vref plus 10, no flaps equals an adjusted Vref plus 20, etc. In addition, there is an additional airspeed penalty that should be applied if you need to maneuver in order to land. That penalty is also 10 knots. You should therefore maintain a minimum of Vref + 30 knots configured clean if maneuvering is necessary in order to land. We typically circle with landing gear extended and flaps set at the approach setting, 15°. Therefore, the minimum airspeed I would recommend during the circle to land maneuver is Vref+20 knots. Frequently, this airspeed penalty results in a minimum speed at the lower limit of Category C approach speeds. Between 120 and 140 knots is a great airspeed to plan to circle the Citation, regardless of whether it is a Citation I, II or V.

We suggest configuring to approach flaps within 5 miles and no later than 2 miles to the final approach fix. Then at the final approach fix call for gear down and the landing check. Power should be at or near flight idle thrust and your vertical descent rate between 800 and 1000 feet per minute during step downs. As we discussed earlier, if the equipment on your airplane provides you with a WAAS derived glide slope, you can fly the approach as you would fly an ILS. Otherwise, I would suggest you descend promptly and start peeking through the clouds for your airport. As you level off at intermediate step downs and finally at the minimum descent altitude, be sure you remember to advance thrust, typically back up to 500 to 600 lbs per side fuel flow. This will prevent airspeed from decaying after you level off. As you get the runway in sight, maintain circling minimum descent altitude until you are in a position from which a normal landing can be made. I frequently get asked "when can I leave circling minimums, downwind, base or final?" The answer is "it depends". If you are circling between 3 and 400 feet AGL as is frequently the case in flat country, you should probably be making your base to final turn before descending below the MDA. As circling minimums approach or exceed 1000 feet as in mountainous regions, it may be appropriate to leave circling minimums on downwind in order to make a normal landing. Remember, this maneuver is not necessarily flown as a rectangular pattern but more as a minimum radius turn. The object is to stay as close to the point of intended touchdown as possible to reduce the probability of flying back into the clouds or losing sight of the runway due to limited visibility. After landing is assured, flaps may be selected to "land".

As you can imagine, you have just flown upwards of 2 hours, depending on traffic. That is the minimum time it takes to cover all maneuvers in preparation for the Type Ride and I don't see how it can be done in less time. Even at that, it's a lot to do and a lot to learn in a couple of hours. I have heard of schools training and typing students in an hour or less total and I can only shake my head and wonder who is overseeing that operation.

Next comes your debriefing, which should be educational as well, an extension of learning. If additional training is necessary, then so be it. If not, your instructor will fill out the proper paperwork documenting your training flight. Even though there are always variables in any flight check such as the airports involved the order of tasks, there should be few surprises on a checkride properly trained and administered per the appropriate Practical Test Standard.