INSTRUMENT FLIGHT RULES
Scenarios for Instrument Flight Instructors
(and for those who wish to fly IFR)
By
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PREFACE

First, a caveat: The opinions expressed herein, and the actual regulations quoted herein will be obsolete on the date of this publication. Afterward the rules are subject to revision – which become effective when they are published in the Federal Register. They are regularly amended by submissions that can be made by any member of the aviation community including you. A "Notice of Proposed Rule Making" (NPRM) is then widely distributed, allowing a time during which comments and suggestions may be submitted. Each comment is evaluated individually. Changes are often the result of a single comment by one individual.

Examiners strive to test the Correlation Level of Learning.
All FAA instructors have learned the four basic levels of learning contained in The *FAA Aviation Instructor's Handbook (FAA-H-8083-9.* When we learn something new, we go through roughly four levels of learning. The first is *"Rote"* the beginning level, then we rise "*Understand*," then we can demonstrate how to "*Apply"* them, and finally we "*Correlate"* what we have learned with what we know from other experiences or other disciplines. Pilot examiners test at the *Correlation* level as often as possible.

The Big Question:
The big question that should be foremost throughout an instrument flight is How Low Can I Go? We know the protection of MEA and MOCA but we must also know when we are off airways, on radar vectors, or on part of an approach. To put it another way, the pilot's main job in IMC is "Stay Out of the Dirt?"

How to read Federal Aviation Regulations (FAR):

Most pilots only read the FARs during the week before a check-ride or knowledge test. Instructors, and Designated Pilot Examiners must refer to them daily in order to answer student questions. This article provides sample scenarios for teaching the FARs in depth. These scenarios will help you and your students think outside the box (or at least to the edges) to see what the FARs say, and what they don't say.

FARs are written by lawyers, proofread by lawyers and interpreted by lawyers. Revisions are reviewed by a team of lawyers. New sections have to dove-tail with regulations from all federal agencies. This is why so many regulations seem so convoluted. It is imperative that you learn to read this jargon.

Here are a few tricks to help find your way through the maze. Whenever you need to interpret a rule or procedure, fight the tendency to pull something out of your fuzzy - long-term memory. Resist starting with "someone told me" or "I heard somewhere." Go to the original publication and follow all the side-tracks to ensure that you are following the full context.

1. Follow the outline format back to the paragraph number and resolve all commas, semicolons and other sequencing punctuations. Note each *"and," "or,"* and *"but not."* This will help you find the outline levels that may include or exclude a pertinent factor.

2. Think creatively to find other regulations that might apply.

3. Refer frequently to Definitions contained in 14CFR §1, §61.1 and the AIM Pilot/Controller Glossary.

4. All instructors should have a current version of the book "FAR/AIM Explained" (Jetlaw). This is a very credible book that examines FAA legal interpretations and court cases on each segment. It includes cross references to pertinent FAA manuals and Advisory Circulars. The authors are highly experienced in aviation law as both lawyers and pilots. They have done their research to find all applicable documents. Make sure you have the current version.

5. Once you are sure you know what the rule says, then ask yourself - "What does it say I can do within this rule?" Be creative. Also ask – "What does it *not* say that I cannot do?"

We will review the Instrument Flight Rules with each applicable Level of Learning shown appropriately. The actual rule will be indented, and in 10-pt *Arial* font. Authors comments will be in 12-pt Times New Roman.

Instrument Flight Rules Part 91.167 – 187

(Surprisingly there are only twenty of them.)

§91.167 ***Fuel requirements for flight in IFR conditions*****.**

(a) No person may operate a civil aircraft in IFR conditions unless it carries enough fuel (considering weather reports and forecasts and weather conditions) to—

(1) Complete the flight to the first airport of intended landing;

(2) Except as provided in paragraph (b) of this section, fly from that airport to the alternate airport; and

(3) Fly after that for 45 minutes at normal cruising speed or, for helicopters, fly after that for 30 minutes at normal cruising speed.

(b) Paragraph (a)(2) of this section does not apply if:

(1) Part 97 of this chapter prescribes a standard instrument approach procedure to, or a special instrument approach procedure has been issued by the Administrator to the operator for, the first airport of intended landing; and

(2) Appropriate weather reports or weather forecasts, or a combination of them, indicate the following:

(i) *For aircraft other than helicopters.* For at least 1 hour before and for 1 hour after the estimated time of arrival, the ceiling will be at least 2,000 feet above the airport elevation and the visibility will be at least 3 statute miles.

(ii) *For helicopters.* At the estimated time of arrival and for 1 hour after the estimated time of arrival, the ceiling will be at least 1,000 feet above the airport elevation, or at least 400 feet above the lowest applicable approach minima, whichever is higher, and the visibility will be at least 2 statute miles.

§.167 (a) When an examiner asks an applicant about the fuel requirements for an IFR flight, the usual answer is a *rote* paraphrase of section (a) above.

Rote: "Carry enough fuel to complete the flight to the first airport, then to the alternate airport, plus 45-minutes at normal cruise speed."

The next two levels are easy:

Understanding: This rule intends for us to make it to our destination with enough fuel complete our flight with a little reserve. It doesn't say anything about the fuel used for two or three approaches, two or three missed approaches, a departure climb at Vy and climb-power, and a possible hold.

Application: You should Calculate how many gallons we need to do all that, and then to fill the tanks to at least that level before takeoff.

Correlation:
Correlation means seeing how unrelated factors might affect the situation - things such as wind, weather, vectors for traffic and other time-consuming surprises that we might encounter.

During preflight, we must imagine how our complete flight might go wrong. (1) We have enough fuel to get to our destination.

(2) We shoot an approach. We were not specifically told to plan 15-minutes for the approach, but that's a good estimate. We still have 30-minutes of reserve.

(3) We just barely miss the approach and decide to try again. Another 15-minutes. We are down to 15-minutes reserve at our alternate.

(4) We miss the second approach and "cruise" on to our alternate.

(5) Our departure climb burns more fuel than at cruise. We have just enough fuel to shoot a straight-in approach. The best we can hope for is someone to tow us off the runway.

In addition to the minimum fuel required by the rule, how much must we add for known additions using estimated average times:

• Each approach (two at destination and one at alternate)	15-minutes x 3 =	45
• Each missed approach climb at Vy power to about 3000 AGL	5-minutes x 3	15
• Climb to assigned altitude to alternate (roughly 7500 AGL)	15-minutes	15
	Total	**75-min**

During the flight we must continuously consider the various conditions and events that might affect the fuel we need in a "worst case" situation Your *Correlation* mind should be considering alternatives to following this plan into the black hole. You may be faced with the "Sully Dilemma" where all your alternatives are blocked and you have to think "outside the box" – quickly! We might consider other alternatives. Weather permitting, we may land short of our destination for additional fuel. We might take the airline which just happens to be going to our destination. We might hire someone with more experience and a more capable airplane. . . .

§.167 (b) *Rote:* No alternate required with weather forecast to be 2000 and 3 or better for 1 hour before and after your ETA.

Understanding: Basically, if the weather is very good, you don't need to file an alternate. You could fly VFR with 1000 and 3, but this seemingly conservative requirement is to ensure that you could fly enroute in IMC and be pretty sure to break out well above minimums at your destination.

Application: Plan a flight to an airport that is forecasting 2000 and 3 for the required time without filing an alternate.

Correlation: Consider as many possibilities and you can.

Unfortunately, this rule doesn't cover all airports. As described in AIM Para. 5-1-10 there are a few airports where *minimums* are near or above 2000 and 3. Check out Aspen (KASE).

Scenario: Let's say you to get a short-notice invitation to fly to Aspen. Yeah! – bring your skis! The good news: the forecast for the day is 2000 and 3. You don't need an alternate. The bad news is that this *forecast* is below minimums for all approaches.

There is a much better rule for "No Alternate Required" contained in §135. Commuter and On Demand Operations Rules. Paragraph §135.223(b) states that you are not required to file an alternate if "(1) The ceiling will be at least 1,500 feet above the lowest circling approach MDA … or 2000 feet above the airport whichever is higher, and (2) Visibility for that airport is forecast to be at least three miles, or two miles more than the lowest applicable visibility minimums, whichever is the greater."

For the above example, the circling MDA for the LOC/DME-E at Aspen is 9840 MSL. Taken literally adding 1500 ft would require a ceiling of 11340 MSL. The regulation refers to MDA, but you must convert to Height Above the Airport (HAA). The HAA at 9840 MSL is 2003 AGL. If the ceiling at KASE is forecast to be 3600 and the visibility, 5-miles, the §135 pilots do not need an alternate. This regulation covers all airports. We have the option of using either 91 or 135 whichever is higher.

§91.169 ***IFR flight plan: Information required.***

(a) *Information required.* Unless otherwise authorized by ATC, each person filing an IFR flight plan must include in it the following information:

(1) Information required under §91.153 (a) of this part;

(2) Except as provided in paragraph (b) of this section, an alternate airport.

b) Paragraph (a)(2) of this section does not apply if:

(1) Part 97 of this chapter prescribes a standard instrument approach procedure to, or a special instrument approach procedure has been issued by the Administrator to the operator for, the first airport of intended landing; and

(2) Appropriate weather reports or weather forecasts, or a combination of them, indicate the following:

(i) *For aircraft other than helicopters.* For at least 1 hour before and for 1 hour after the estimated time of arrival, the ceiling will be at least 2,000 feet above the airport elevation and the visibility will be at least 3 statute miles.

(ii) *For helicopters.* At the estimated time of arrival and for 1 hour after the estimated time of arrival, the ceiling will be at least 1,000 feet above the airport elevation, or at least 400 feet above the lowest applicable approach minima, whichever is higher, and the visibility will be at least 2 statute miles.

(c**)** *IFR alternate airport weather minima.* Unless otherwise authorized by the Administrator, no person may include an alternate airport in an IFR flight plan unless appropriate weather reports or weather forecasts, or a combination of them, indicate that, at the estimated time of arrival at the alternate airport, the ceiling and visibility at that airport will be at or above the following weather minima:

(1) If an instrument approach procedure has been published in part 97 of this chapter, or a special instrument approach procedure has been issued by the Administrator to the operator, for that airport, the following minima:

(i) *For aircraft other than helicopters:* The alternate airport minima specified in that procedure, or if none are specified the following standard approach minima:

(A) *For a precision approach procedure.* Ceiling 600 feet and visibility 2 statute miles.

(B) *For a nonprecision approach procedure.* Ceiling 800 feet and visibility 2 statute miles.

(ii) *For helicopters:* Ceiling 200 feet above the minimum for the approach to be flown, and visibility at least 1 statute mile but never less than the minimum visibility for the approach to be flown, and

(2) If no instrument approach procedure has been published in part 97 of this chapter and no special instrument approach procedure has been issued by the Administrator to the operator, for the alternate airport, the ceiling and visibility minima are those allowing descent from the MEA, approach, and landing under basic VFR.

(d) *Cancellation.* When a flight plan has been activated, the pilot in command, upon canceling or completing the flight under the flight plan, shall notify an FAA Flight Service Station or ATC facility.

§.169 (a) Supply all the information from the VFR flight plan, and an alternate if required.

§.169 (b) The wording of this paragraph, and the discussion is identical to §167 (b) above.

§.169 (c) IFR alternate weather minima.
We can not include an alternate airport unless the weather is forecast to be above the alternate minima for the approach to be used at the ETA. If the approach has no published alternate minima we need:

Rote:

- Published alternate minimums, or if none:
- Precision approach – 600 and 2.
- Non-Precision app – 800 and 2.
- If your alternate has no approach, you must be able to descend from the nearest airway MEA and make a VFR approach and landing.

Application: File a flight plan to an airport that has 200 and ½ and include an alternate, which forecasts 800 and 2.

Correlation
The forecast at your alternate (with ILS) was 700 and 2. You do not see anything at ILS minimums. You find that the weather at your ILS equipped alternate is now 300 and RVR 2800.

There are no wrong answers to the following questions. Their purpose is to invite your *correlation* mind to play "What If."

- What are your alternatives?
- What conditions would lead you to shoot another approach?
- Or divert to your alternate?
- What if you miss your approach at your alternate?

If you decide to continue to your alternate, it has now become your destination so "destination" minimums apply. However, you no longer have a legal alternate.

§.169 (d) Cancellation. When a flight plan has been activated, the pilot in command, upon canceling or completing the flight, shall notify an FAA Flight Service Station or ATC facility.

That's the *Rote* answer.

Understanding: When we arrive at a tower-controlled civilian airport, the tower automatically closes an IFR flight plan when the controller observes the aircraft landing. At non-tower airports we must close it with FSS or by phone.

> **§91.171 *VOR equipment check for IFR operations.*** (This part will be paraphrased for simplicity and brevity.)

(Your *correlation* mind is thinking. VOR?!? Yes VOR. The **V**HF **O**mnidirectional **R**ange system is ground-based with years of credibility and operational experience. If your airplane has a VOR receiver in it, a pilot must have logged a receiver check within the preceding 30-days following one of the procedures listed below.)

§.171 *Rote:* The VOR may be tested as follows:

1. An FAA certified VOR Test signal (VOT), or a test signal radiated by an appropriately-rated repair station,
2. A designated VOR system checkpoint on the airport surface,
3. A designated airborne checkpoint,
4. A prominent point along a VOR airway, preferably more than 20 nm from the VOR,
5. Dual VORs, one against the other.

Understanding: This simple rule requires critical reading. Let's evaluate each option:

1. The VOT broadcasts the 360-Radial. (360 From and 180 To). The permissible error of the centered needle is plus or minus 4-degrees. You should check both 360 F and 180 T.
Can the VOT be used airborne? The answer is possibly - but airborne use is strictly limited to those areas/altitudes specifically authorized in the appropriate Chart Supplement.

2. A designated surface checkpoint. The aircraft will be taxied to a painted circle on the surface of the airport of intended departure with a small reference point in the middle. You will find the test radial and DME distance posted conveniently. The aircraft should be aligned with the radial with the VOR *antenna* as exactly as possible over that point. The permissible error is 4-degrees.

3. If a ground test is unavailable you may use a designated airborne checkpoint listed in the appropriate Chart Supplement.

Application: A recommended technique is to fly outbound on the published radial to a point abeam the designated point. If the point passes on your left, turn the OBS 6-degrees lower (6-degrees higher if it passed on the right). Circle back and track that radial. Track it with reverse sensing (back course) to reduce error sources. If the new setting takes you on the other side of the ground point, you are within the 6-degree permissible error.

4. If there is no convenient designated airborne checkpoint, a prominent point along a VOR airway, preferably within 20 nm of a VOR may be used. The permissible error is 6-degrees.

5. If two separate VORs (except for the antenna) one may be tested against the other. The permissible error is 4-degrees. This is usually done on the ground before takeoff at airports within range of a VOR. However, this check is permitted airborne because it does not specify "at the airport." This is the only airborne test permitting 4-degrees of error.

Correlation: Scenario: You have just tested both VORs at the airport using the above dual VOR procedure and found 18-degrees difference. You may use either VOR if it passes any other test. You might check them both at a designated surface check point at the airport. If one passes the test, the other should be placarded "INOP" and "rendered inoperative as required by 91.213.

But what if the wild one contains the ILS localizer-glideslope display? VOR accuracy tests do not apply to the ILS because both localizer and glide slope rely on discrete horizontal and vertical signals rather than radials. However, there may be other reasons not to count on the ILS.

§91.173 *ATC clearance and flight plan required.*

> No person may operate an aircraft in controlled airspace under IFR or in weather conditions below VFR unless that person has –
> (a) Filed an IFR flight plan; and
> (b) Received an appropriate ATC clearance

This very simple regulation is more involved than it appears.

Understanding:
What about a pop-up clearance? When issuing a pop-up clearance, ATC automatically files enough information to fit you into the system before issuing the clearance.

It doesn't say anything about IFR in uncontrolled airspace! You're on your own in Golf. It is perfectly legal for an instrument rated pilot in an instrument equipped airplane to fly IMC in uncontrolled airspace without a flight plan or a clearance. This concept is only addressed here, and it is addressed by omission with full consideration of the implications.

The purpose of Controlled Airspace is to separate IFR and VFR traffic. It is pretty obvious who's separating us in Alpha, Bravo and Charlie airspace, but who separates us in Echo airspace? We are separated by §91.155. VFR aircraft must maintain cloud separation and visibility– requiring us all to see and avoid each other when we pop out of the clouds. In Golf, we are on our own. VFR pilots must remain clear of clouds with one mile visibility, but instrument pilots in properly equipped aircraft can just pop in and out of the clouds willy-nilly.

Golf airspace is found below 1200 AGL under Echo airspace, or below 700 AGL at non-towered airports which have an instrument approach. When you descent below 700 AGL on an approach you are in Golf airspace even on an IFR clearance.

There is also Golf airspace above FL600.

Application/Correlation: Here's a scenario that might tempt an instrument pilot to legally enter the clouds in Golf airport surface area. Flying home in clear weather you notice fog forming at your destination at about 500 AGL. The ILS is operating, and it is possible to intercept the glide slope in VFR conditions above 700 AGL and land with as little as 1/2 SM flight visibility. At the same time an instrument pilot with knowledge of the conditions may decide to take off in the other direction without talking to anyone. Both would be legal (except possibly for §91.13).

***** §91.175 *Takeoff and landing under IFR* *****

This is the big one You must be able to apply several parts of this rule instantaneously. This is literally where the rubber meets the road! Some parts require immediate recall and interpretation. Some are often misunderstood, so you must find their true intent. To enhance continuity we will discuss each paragraph as it comes up.

> **§91.175 (a) Instrument approaches to civil airports.** Unless otherwise authorized by the FAA, when it is necessary to use an instrument approach to a civil airport, each person operating an aircraft must use a standard instrument approach procedure prescribed in part 97 of this chapter for that airport. This paragraph does not apply to United States military aircraft.

§.175 (a) *Rote:* You cannot make up your own approach.

Understanding: Using approved instrument approaches to civil airports seems logical. If you intend to use instrument references to descend below minimum IFR altitudes, you must use an

FAA standard instrument approach procedure. It is not legal to design your own approach to a familiar field. Unfortunately, glass panel displays lead us to feel safe in descending in IMC with near-virtual reality on the instrument panel. However, approved approaches have been carefully surveyed and checked against the Obstacle Clearance Plane that we cannot casually evaluate.

Application/Correlation: You got your student, private and instrument certifications at this non-towered airport. You know that there is no "standard instrument approach," but you have never been concerned about obstacles during your hundreds of VFR takeoffs and landings. Upon your return from a crystal-clear flight you are surprised by a low stratus layer covering the airport. Now most of you will have created a waypoint at the threshold of your runway and constructed a "practice GPS approach." Your CFII may have had you practice it at the end of your training flights just to get home. This does not mean that it is safe in IMC.

For those of you who have surveyed an airport for a standard approach procedure, it is surprising how many things stick up into the clearance plane that are usually unnoticed on a clear VFR day.

> **§91.175 (b) Authorized DA/DH or MDA**. For the purpose of this section, when the approach procedure being used provides for and requires the use of a DA/DH or MDA, the authorized DA/DH or MDA is the highest of the following:
>
> (1) The DA/DH or MDA prescribed by the approach procedure.
>
> (2) The DA/DH or MDA prescribed for the pilot in command.
>
> (3) The DA/DH or MDA appropriate for the aircraft equipment available and used during the approach.

§.175 (b) *Correlation:* Segment (2) refers to a concept not contained in Part 91where the PIC might be "prescribed a higher minimum. Interestingly, while a new instrument pilot may legally descend to published DA/DH or MDA as low as 200 ft AGL, a highly experienced airline captain transitioning to a new aircraft may not descend to published minimums until having flown 100 hours as PIC in that type of airplane (§121.652).

§91.175 (c) Operation below DA/DH or MDA. (We will paraphrase this segment.)

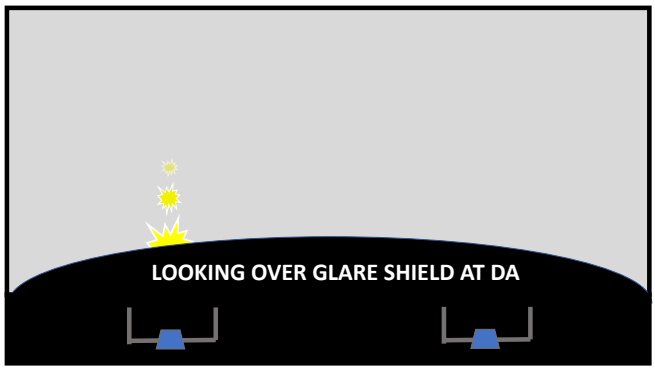
This paragraph is the most critical of any IFR rule. Paragraph (c) lists three conditions which must be met before operating below the authorized MDA or continuing below DA/DH.

Rote:

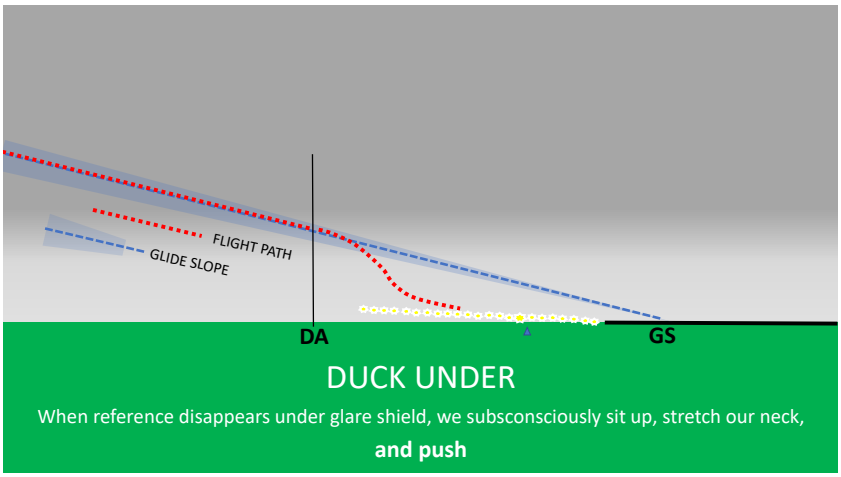
1. The aircraft must continuously be in a position to land at a normal rate of descent using normal maneuvers. (123 and 135 operations must touch down in the Touchdown Zone.)
2. The *flight* visibility is not less than that prescribed for the approach being used.
3. At least one of the following references is distinctly visible and identifiable.

§.175 (c)(1) *Understanding:* Condition Number 1. is intended to keep the pilot from setting up a high rate of descent or some other wild maneuver while transitioning to visual. The illustration

below shows what happens when the pilot just barely sees a reference disappearing under the glare shield. (The dreaded "Duck Under")



The tendency is to sit up tall, stretch your neck and subconsciously push the glare shield out of the way. This creates the following flight path:



§.175 (c)(2) Condition Number 2. has been misunderstood since the wording was changed back in the 1980's. The old wording stated: "required visibility" meaning what could be seen from the tower or RVR. This required an official weather observation. Sometime back in the 1980's the word "flight" was added as follows: "required FLIGHT visibility!" This put the decision in the cockpit. As a result, you must decide within about half a second if you have the required *flight* visibility and can safely maneuver to the runway.

§.175 (c)(3) Condition Number 3. describes the "runway environment" very precisely to preclude pilots from using local knowledge, such as the Fast-Food restaurant on the next block. There are now ten specific visual references – one of which must be identified. For simplicity we can conceive of them as "pavement, paint or lights" that were put there by the airport manager to help pilots identify the specific runway being used.

The first of these ten references is the approach light system – with the caveat that the pilot may not descend below 100 ft HAT seeing only the approach lights unless the red side row bars (which begin 1000 ft from the threshold) are clearly visible. It should be noted that only the

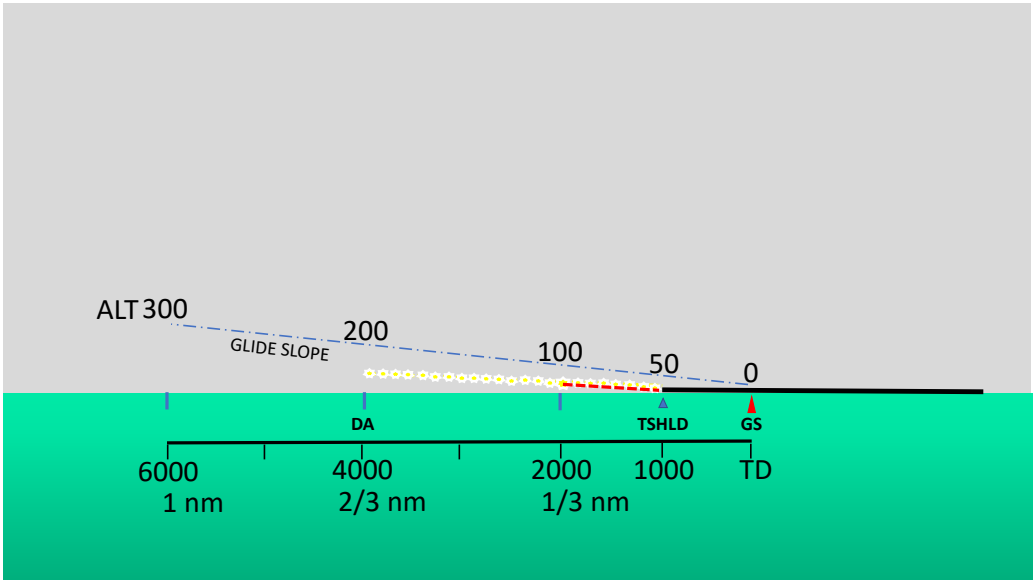
ALSF-2 has red side row bars. However, all approach light systems except ODALS have a wide, three-segment line of white lights beginning 1000 ft from the threshold.

Correlation/Scenario: Having flown a challenging flight to an airport with varying weather, you arrive at DA/DH and you see – *something!* You must *immediately* interpret the visual cues and decide to either land or perform a missed approach. Let's say that you see the sequence flashers. "Now le-me-see – uh that's part of the approach light system, so I can – What did it say?"

This exception allows you to go a little lower to gain a better reference. However, this leaves you in an ambiguous situation. Let's say that you have descended to 100 HAT and can now see the red side row bars. Can you continue? The rule says yes, but you do not have the required flight visibility. At 100 HAT you are 1000 ft from the threshold. The red side row bars start 1000 ft from the threshold. You are over them. You are allowed to continue, but you should Go Around if you see something ambiguous while moving at least 150 feet per second.

The diagram below shows the vertical profile of the last nautical mile of the glide slope. At 100 HAT you are 2000 ft from the glide slope shack, which is 1000 ft down the runway at the "Runway Aiming Point Marking." That puts you only 1000 ft from the threshold.
If you see all the way to the threshold from 100 ft from that point, your flight visibility is – 1000 ft. At that point you must also be able to see the VASI, or the big wide "Aiming Point Markers."

Here is the ILS vertical profile showing altitudes along the last nautical mile of the glideslope. At 200 ft you are approximately 3000 ft from the runway threshold. If you have one-half mile visibility at DA/DH you should at least be able to see the beginning of the side row bars.



By the way, it does not say that you may descent 100 ft lower, it says you can go to 100 HAT even on a non-precision approach. In that case these calculations are not helpful.

§91.175(d) Landing.

No pilot operating an aircraft, may land that aircraft when the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used.

§.175 (d) The term "flight visibility" also occurs in this rule. These two sections, (c) and (d) refer to the required weather to descend and land. They are not legally related to the reported ceiling or reported visibility. Both ceiling and visibility were required when planning for alternates, but not in the actual decision to descend, or land. The only time the FAA or NTSB can second-guess the pilot on whether the flight visibility was sufficient is when you land off the runway. It is *your* decision. That's why you are paid the big bucks.

§91.175 (e) Missed approach procedures. Each pilot operating an aircraft …, shall immediately execute an appropriate missed approach procedure when either of the following conditions exist:

(1) Whenever operating an aircraft pursuant to paragraph (c) of this section or …, and the requirements of that paragraph or section are not met at either of the following times:

(i) When the aircraft is being operated below MDA; or

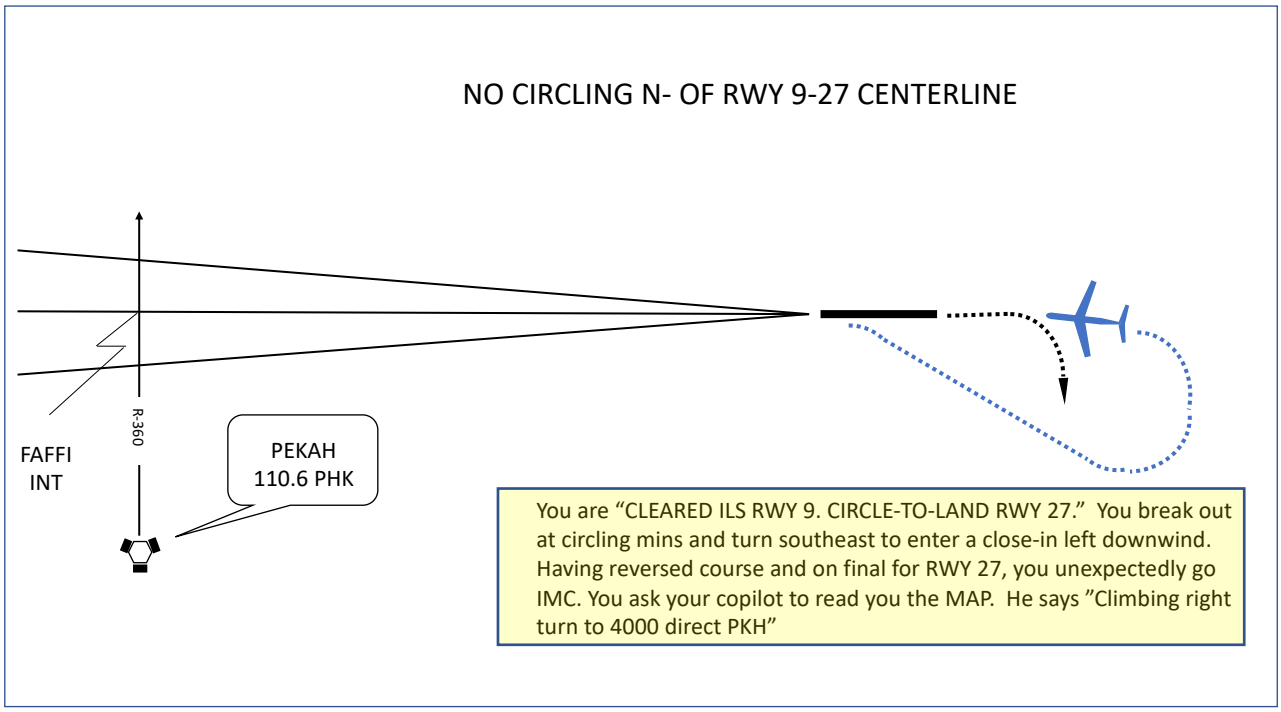
(ii) Upon arrival at the missed approach point, including a DA/DH …, and at any time after that until touchdown.

(2) Whenever an identifiable part of the airport is not distinctly visible to the pilot during a circling maneuver at or above the MDA, unless the inability to see an identifiable part of the airport results only from normal bank of the aircraft the during circling approach.

§.175 (e) *Rote:* This rule is fairly clear. "Don't mess around near the ground!"

Application/Correlation:
Scenario 1. Your missed approach procedure requires an immediate climbing turn. You see the runway and continue. As you float past threshold at about 50-feet you lose forward visibility (blowing snow). You are now well beyond the missed approach point and no longer in position to stay within the "turning missed approach" surface (see TERPS). What now? If you are unable to contact ATC, you might also use the Obstacle Departure Procedure for the closest aligned runway – but now is not the time to look it up.

Scenario 2. You are on your way to your second – unplanned alternate, Mountain Gulch International (see following figure). Your copilot is an experienced instrument pilot, and it's your turn to fly. You are "CLEARED ILS RWY 9, CIRCLE TO LAND RWY 27." It has been a long dark night. Your clearance is shown below with the pertinent parts of the approach chart.



This scenario has killed several pilots (in a simulator) when they turned right and flew into the ridge north of the airport. Which brings up the question: what do you do if you have started to circle here, and you are in various positions on the circle?

The AIM has three enlightening pages describing "Missed Approach" in the AIM Para 5-4-21. We recommend you read them now rather than in the middle of circling approach.

> **§91.175 (f) Civil airport takeoff minimums.** *(Note: "This paragraph only applies to persons operating an aircraft under part 121, 125, 129, or 135 of this chapter.)*
>
> (1) Unless otherwise authorized by the FAA, no pilot may takeoff from a civil airport under IFR unless the weather conditions at time of takeoff are at or above the weather minimums for IFR takeoff prescribed for that airport under part 97 of this chapter.
>
> (2) If takeoff weather minimums are not prescribed under part 97 of this chapter for a particular airport, the following weather minimums apply to takeoffs under IFR:
>
> (i) For aircraft, other than helicopters, having two engines or less—1 statute mile visibility.
>
> (ii) For aircraft having more than two engines— ½ statute mile visibility.
>
> (iii) For helicopters— ½ statute mile visibility.

§.175 (f) *Understanding:* This paragraph does not apply to those of us operating under part 91. A newly rated instrument pilot may legally take off with Zero Visibility.

Correlation: There are some interesting implications. For example, although a newly minted instrument pilot may legally take off in 10 ft visibility or less, those carrying paying passengers for hire in single and twin-engine airplanes are required to wait until they have one-mile visibility.

There is an underlying caveat for all aviation regulations. They are written in blood. This rule shows exactly who's blood they are protecting. Parts 121 through 135 listed above all involve paying passengers.

There is a practical minimum for part 91 pilots. At some point you will need a white cane to find your airplane, let alone the correct taxiway. Additionally, it is hard to find "Zero-Zero" weather. It usually clears up completely while you are trying to find your airplane.

I hesitate to suggest techniques for an instrument take off (ITO) in real weather. You are very close to things near the runway and a little drift goes a long way. Maintaining runway alignment is the greatest danger until you are firmly airborne. Imagine seeing no more than two runway center lines as you start your roll, decreasing to half of a center line as you approach 60 kts as dew drops roll around on your windscreen. You must see enough to line up with the centerline. If you manage to get airborne and immediately engulfed in clouds, you need to immediately transition to instruments, maintain your heading and maximize your rate of climb.

The standard IFR departure requires a minimum climb rate of 200 per nautical mile. This allows you to clear the 40:1 Obstacle Clearance Plane which is 152 ft per nautical mile. That means if the obstacle is on your course one mile out, and you climb 200 ft per nautical mile, you will overfly the obstacle by 48 ft. But what if the departure specifies a minimum climb gradient higher than 200 ft per NM, and you can just barely do that? You will be 48 ft over *that* obstacle. We get complacent climbing out over the 200 ft per NM surface during VFR training. We can meet that at 90 kts climbing only 300 fpm. But if you are required to climb at a published higher number, you might just barely clear the obstacle at maximum climb.

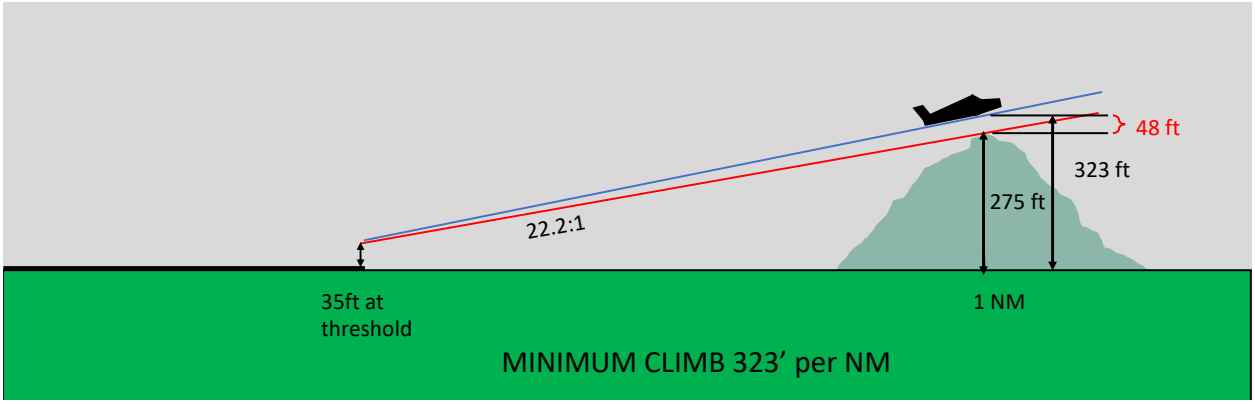
Correlation: Here's the scenario: Somewhere in West Virginia there's an airport at 1175 elev. It has a SID requiring a straight-out departure and a 323 ft per NM climb to 3000. You check the sectional and find an 1800 ft ridge two NM from the departure end. The ridge is approximately 625 ft above field elevation. You know that you can climb at 500 fpm at 90 kt (Vy).

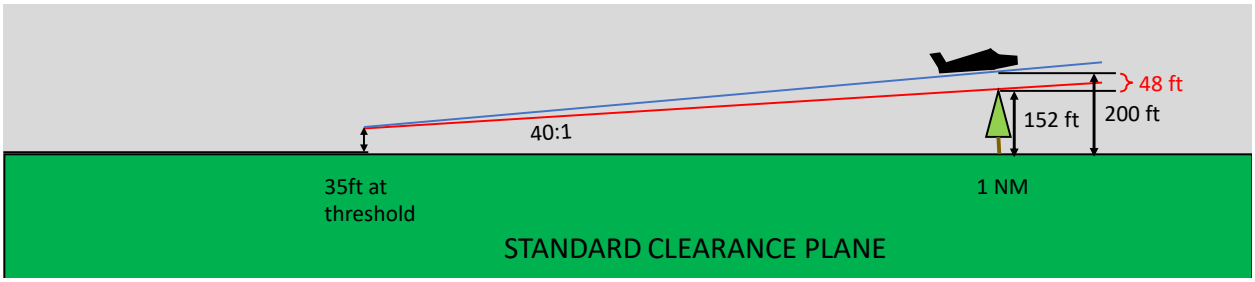
But wait! The departure requires 323 ft per *Nautical Mile*, not 323 Feet Per Minute. To climb 323 ft per NM at 90 kts requires climbing at 485 fpm. The airport is at 1175 and the ridge is at 1800. After two miles you would have climbed 720 ft at 90 kts, clearing the ridge by 95 ft.

Here's what happened when a "very close acquaintance" actually tried this in VFR conditions.

"The ridge seemed pretty close. I was planning to takeoff VFR and turn early but decided to fly the SID just to see what it looked like. Immediately after gear-up I noticed the ridge was going to be close, so I stayed precisely at max climb speed – something I might not have done in the clouds. The ridge was covered by an old growth forest, (sparsely populated).

About halfway there I saw that the ridge was descending slowly against the background, indicating that we would pass over it, but not by much. As we got closer, I saw that the trees were pretty tall. I wondered how much they had grown since they were surveyed. I passed over them by roughly 100 ft or less."





"My takeaway was this, after anxiously watching that ridge slowly slide down the wind screen, I decided: If you can just barely meet the minimum climb gradient, do it in the clouds. Why die all tensed up?"

> **§91.175 (g) Military airports.** Unless otherwise prescribed …, each person operating a civil aircraft under IFR into or out of a military airport shall comply with the instrument approach procedures and the takeoff and landing minimum prescribed by the military authority having jurisdiction of that airport.

§.175 (g) *Rote/Understanding:* It is possible to legally land at a U.S. military airport. However, you must get prior permission from Base Operations. Your host will help with the process. You must also file, open and close your IFR flight plan with both the FAA and Base Ops. Ask your host for specific instructions for this.

> **§91.175 (h) Comparable values of RVR and ground visibility.**
>
> (1) If RVR minimums for takeoff or landing are prescribed in an instrument approach procedure, but RVR is not reported for the runway of intended operation, the RVR minimum shall be converted to ground visibility in accordance with the table in paragraph (h)(2) of this section and shall be the visibility minimum for takeoff or landing on that runway.

(2)

RVR (feet)	Visibility (statute miles)
1,600	1/4
2,400	1/2
3,200	5/8
4,000	3/4
4,500	7/8
5,000	1
6,000	1 1/4

Rote/Understanding

§.175 (h) *Application/Correlation:* Scenario: You are approaching KLAX, and cleared for a straight-in ILS or LOC RWY 24R. The MDA/weather minimums section shows:

[322/18 200 (200-1/2)]

What is the visibility requirement if the RVR is not working? What is the visibility requirement if it is working? Exactly the same – **1/2 mile *flight* visibility**.

Well then, what is the value of publishing RVR 18? This low value requires enhanced lighting systems. Passenger carriers (Part 135, 121, etc) are not allowed to pass the FAF unless weather at that time is reported to be above the required minimum. If RVR 18 is published, they can start the approach if it is reported at 1800.

Publishing RVR 24 would require them to abandon the approach at the FAF/GS intercept. Remember that both §91.175(c) and (d) require that the *flight* visibility is not less than that prescribed for the approach. The RVR value is merely advisory for Part 91 pilots – and for that matter, passenger carriers after passing the FAF. A low value means that you might not see enough to safely land, but the critical factor at this point is *flight* visibility.

> **§91.175 (i) Operations on unpublished routes and use of radar in instrument approach procedures.**
> " …When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with §91.177, **maintain the last altitude assigned to that pilot until the aircraft is established on a segment of a published route or instrument approach procedure unless a different altitude is assigned by ATC.** After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC.

§.175 (i) There is a full discussion of this rule in AIM 5-4-7 f. The term "published route" implies a published minimum altitude.

This is another very rich segment. It was added after a TWA 727 crash at Washington Dulles in 1974 where the flight crew was shooting a VOR/DME approach (Google TWA 514 crash). The rules at the time stated that when on "vectors to final" and cleared for the approach you could descend to the Initial Approach Altitude. The investigation revealed a lot of ambiguity so many rules and procedures were revised. You will now hear "Maintain 2000 until established, Cleared for approach,

The crew discussed the difference between their assumed altitude restriction (1800 ft) at Round Hill, and transition altitudes on the chart that indicated 3400 or higher on three published feeder routes to Round Hill. They were discussing this as they passed through 2500, and eventually crashed into Mt Weather at approximately 1675 ft.

As a pilot you must be cognizant of a switch from "Radar Vectors" to "Unpublished route." If while being vectored, you hear "Proceed Direct to" a navigation fix you are no longer protected by the Minimum Vectoring Altitude. If unsure of your position related to higher terrain you should ask for verification of terrain clearance.

> **§91.175 (j) Limitation on procedure turns**. In the case of a radar vector to a final approach course or fix, a timed approach from a holding fix, or an approach for which the procedure specifies "No PT," no pilot may make a procedure turn unless cleared to do so by ATC.

§.175 (j) In addition to this guidance, there is a wonderful gift in AIM para 5-4-9 a. 1.

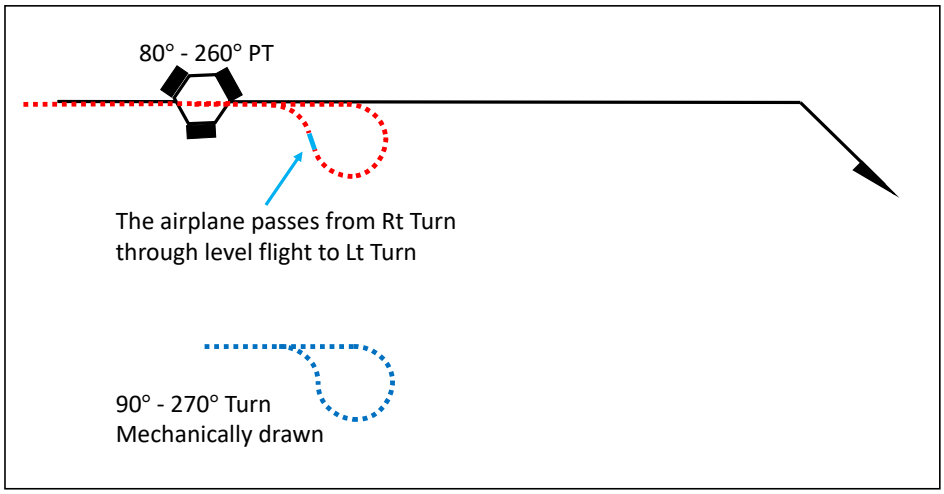
"On U.S. Government charts, a barbed arrow indicates the maneuvering side of the outbound course on which the procedure turn is made. Headings are provided for course reversal using the 45 degree type procedure turn. **However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot** (limited by the charted remain within xx NM distance). Some of the options are the 45 degree procedure turn, the racetrack pattern, the teardrop procedure turn, or the 80-degree – 260-degree course reversal. Racetrack entries should be conducted on the maneuvering side where the majority of protected airspace resides. If an entry places the pilot on the non-maneuvering side of the PT, correction to intercept the outbound course ensures remaining within protected airspace. Some procedure turns are specified by procedural track. These turns must be flown exactly as depicted." (**bold** type added by author)

This is a rare breath of fresh air! Pilots seem to think that we are required to time outbound for two minutes, then turn 45-degrees as depicted. This procedure takes a minimum of eight minutes. Any approved holding entry is legal, and requires only three minutes.
There are only three situations where timing outbound makes sense:

1. Tailwind on final,
2. Altitude to lose before or after the PT,
3. Mental catch-up time.

If you are planning to fly GGGs* you should learn to fly efficiently. Flight departments don't like using 500 extra gal to fly an eight-minute pattern. * Giant Gas Guzzlers

Occasionally you may have the opportunity to fly a two-minute procedure turn. An 80-degree – 260-degree course reversal is practical if you are tracking outbound on the final approach course. Once passed the fix and below the glideslope, turn 80-degrees toward the PT barb, and immediately reverse the turn back to the inbound heading. This would be a 90-270 if done with a protractor, but the smooth roll rate from one bank to the other takes some distance. See the following figure.



§91.175(k) ILS components. (To simplify this paragraph.) The basic components are:

Standard ILS

- Localizer
- Glide slope
- Outer marker (acceptable substitutes):
  - Compass locator,
  - Precision approach radar (PAR),
  - Airport surveillance (ASR),
  - DME,
  - VOR, or NDB fixes identified on chart, or
  - RNAV / GPS fix identified on the chart.

Additional for Category II or III

- Inner marker (substitution by letter of authorization).

§91.176 *Straight-in landing operations below DA/DH or MDA using enhanced flight vision system (EFVS) under IFR.*

(This operation will be covered during transition to your first "Next Gen" aircraft. Your training will include a thorough explanation of this section.)

Now the Big Question: "How Low Can I Go?" Minimum altitudes are published on all IFR charts:

§91.177 *Minimum altitudes for IFR operations.*

(a) *Operation of aircraft at minimum altitudes.* Except when necessary for takeoff or landing, or unless otherwise authorized by the FAA, no person may operate an aircraft under IFR below—

(1) The applicable minimum altitudes prescribed in parts 95 and 97 of this chapter. However, if both a MEA and a MOCA are prescribed for a particular route or route segment, a person may operate an aircraft below the MEA down to, but not below, the MOCA, provided the applicable navigation signals are available. For aircraft using VOR for navigation, this applies only when the aircraft is within 22 nautical miles of that VOR (based on the reasonable estimate by the pilot operating the aircraft of that distance); or

(2) If no applicable minimum altitude is prescribed in parts 95 and 97 of this chapter, then—

(i) In the case of operations over an area designated as a mountainous area in part 95 of this chapter, an altitude of 2,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown; or

(ii) In any other case, an altitude of 1,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown.

(b) *Climb.* Climb to a higher minimum IFR altitude shall begin immediately after passing the point beyond which that minimum altitude applies, except that when ground obstructions intervene, the point beyond which that higher minimum altitude applies shall be crossed at or above the applicable MCA.

§.177 (a)(1)

Rote: The MEA guarantees you two things:

1. Obstacle clearance of 1000 ft in the flat lands and 2000 in designated mountainous areas within 4 nautical miles of the course centerline,
2. Primary route signal coverage.

The MOCA guarantees you two things:

1. Obstacle clearance of 1000 ft in the flat lands and 2000 in designated mountainous areas within 4 nautical miles of the centerline,
2. Primary route signal coverage within 22 nm of the VOR.

Understanding: This section offers the basic answer to the Big Question: "How Low Can I Go?" Although this section is only six paragraphs long, it includes several concepts where misunderstandings can occur.

Correlation: First, some helpful references. Parts 95 *IFR Altitudes* and Part 97 *Standard instrument approach procedures* provide definitions and concepts which shed some light on this

subject. They will not be discussed here because we are limiting the scope to Part 91, however a prudent pilot would take a quick critical look at each to understand the present context.

The best reference is found in Part 97.20 – "FAA Order 8260.3, U.S. Standard for Terminal Instrument Procedures (TERPS"). This publication contains procedures for evaluating the clearance plain for every instrument procedure. TERPS is used in determining minimum altitudes for all IFR procedures. Although TERPS is not required reading for any pilot rating, the prudent pilot mentioned above should Study TERPS enough to understand it's complex organization. You should then be able to find obstacle clearances for approaches, holding patterns, Turning Missed Approaches and any other airspace that catches your interest. It will give you unbelievable peace of mind.

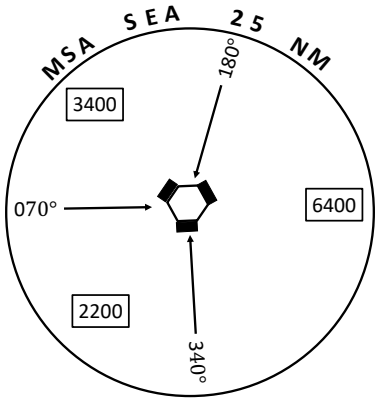
(Part 95 lists and defines in alphabetical order; MAA, MCA, MEA, MOCA and MRA.)

How low can you go when you are not on a published route? Each Latitude-Longitude sector on an enroute chart has a large Off Route Obstruction Clearance Altitude (OROCA) printed in faded font as shown below:

12^{5}

If you are at or above the OROCA you are above any obstruction in that Lat-Long rectangle. You are guaranteed 1000 ft in the flatlands, 2000 ft in designated mountainous areas. It is possible to safely fly at lower altitudes within the rectangle, but you must assure yourself that you will remain 1000/2000 ft above all obstructions within four-nm of your route.

Scenario: You are descending for an approach into a mountainous area. You are being radar vectored below the MEA/MOCA of any route segment in the area. How do you know if you are above the obstacle clearance plane? The first reference is the MSA (Minimum Safe Altitude) circle on the approach plate. MSA provides 1,000 feet of clearance (flatlands or mountainous) over all obstructions within 25 nm of the center reference point. However, it does not assure navigation signal coverage.



But suppose you are being vectored below the MSA? This is an approved procedure used by ATC to facilitate traffic sequencing. The Minimum Vectoring Altitude (MVA) chart (known only to radar controllers) shows obstructions on the radar screen template. This allows more

efficient vectoring. Controllers must keep you from touching the edge of the next higher sector. Sector borders are at least 3 miles from the obstruction. The MVA in each sector provides 1,000 feet above the highest obstacle in the flat lands areas and 2000 ft in designated mountainous areas. This chart is not available to the public. We get familiar with normal vectoring around our home in visual conditions and become complacent. If you venture to strange airports, you must be ready to query the controller when in the clouds.

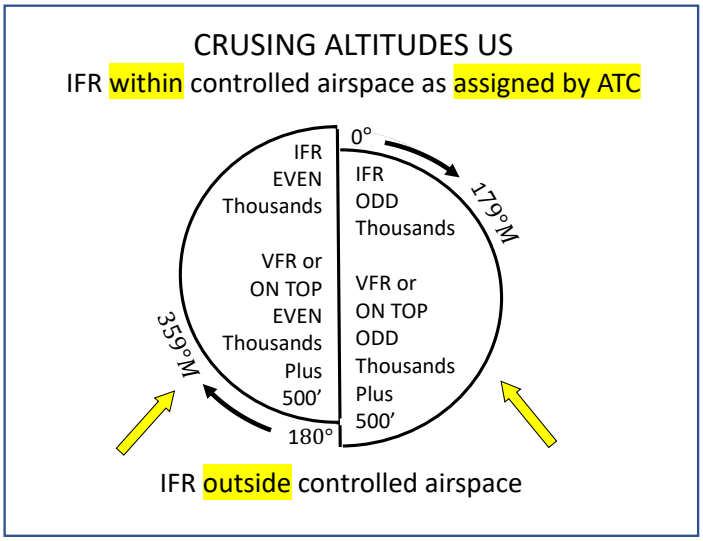
How do you know that a human error on the controller's part might let you cruise into a hill? Controllers have many safeguards and procedures to reduce the likelihood of that occurring. However, it is prudent to question the controller if in doubt. If it happens to you, the controller will be disciplined, and will probably lose his or her job. You may not be so lucky.

§91.179 *IFR cruising altitude or flight level.*

Unless otherwise authorized by ATC, the following rules apply—

(a) *In controlled airspace.* Each person operating an aircraft under IFR in level cruising flight in controlled airspace shall maintain the altitude or flight level assigned that aircraft by ATC. However, if the ATC clearance assigns "VFR conditions on-top," that person shall maintain an altitude or flight level as prescribed by §91.159.

§179 (a) *Rote*, (but this doesn't say what you expect it to say.)
Understanding: This means that you may file an eastbound altitude at 8000, and they can assign you 8000 if it's available. The following is from the L-Chart Legend. Re-read the above paragraph and compare it with the legend below. We all glossed over the highlighted words when we first saw it.



(b) *In uncontrolled airspace.* Except while in a holding pattern of 2 minutes or less or while turning, each person operating an aircraft under IFR in level cruising flight in uncontrolled airspace shall maintain an appropriate altitude as follows:

(1) When operating below 18,000 feet MSL and—

(i) On a magnetic course of zero degrees through 179 degrees, any odd thousand foot MSL altitude (such as 3,000, 5,000, or 7,000); or

(ii) On a magnetic course of 180 degrees through 359 degrees, any even thousand foot MSL altitude (such as 2,000, 4,000, or 6,000)."

(2) When operating at or above 18,000 feet MSL but below flight level 290, and—

(i) On a magnetic course of zero degrees through 179 degrees, any odd flight level (such as 190, 210, or 230); or

(ii) On a magnetic course of 180 degrees through 359 degrees, any even flight level (such as 180, 200, or 220).

(3) When operating at flight level 290 and above in non-RVSM airspace, and—

(i) On a magnetic course of zero degrees through 179 degrees, any flight level, at 4,000-foot intervals, beginning at and including flight level 290 (such as flight level 290, 330, or 370); or

(ii) On a magnetic course of 180 degrees through 359 degrees, any flight level, at 4,000-foot intervals, beginning at and including flight level 310 (such as flight level 310, 350, or 390).

(4) When operating at flight level 290 and above in airspace designated as Reduced Vertical Separation Minimum (RVSM) airspace and—

(i) On a magnetic course of zero degrees through 179 degrees, any odd flight level, at 2,000-foot intervals beginning at and including flight level 290 (such as flight level 290, 310, 330, 350, 370, 390, 410); or

(ii) On a magnetic course of 180 degrees through 359 degrees, any even flight level, at 2000-foot intervals beginning at and including flight level 300 (such as 300, 320, 340, 360, 380, 400)."

RVSM

AIM Chapter 4. Section 6. Operational Policy/Procedures for Reduced Vertical Separation Minimum (RVSM) in the Domestic U.S., Alaska, Offshore Airspace and the San Juan FIR

The FAA has implemented RVSM between FL 290 and FL 410 as Reduced Vertical Separation Minimum Airspace. This will allow opposite direction flights to maintain 1000 ft separation as follows:

Mag Hdgs between 0-degrees to 179-degrees use any odd flight level, and
Mag Hdgs between 180-degrees and 359-degrees to use any even flight level.

Extensive flight crew training and aircraft equipment requirements are set forth in AIM Paragraphs 4-6-1 through 4-6-11, 14CFR 91.179(b), Part 91 Appendix G, and AC 91-85. If either the operator or the aircraft have not met the applicable RVSM standards the aircraft will be referred to as a "non-RVSM" aircraft. Non-RVSM aircraft will be handled on a workload permitting basis using 1000 feet vertical separation.

§91.180 ***Operations within airspace designated as Reduced Vertical Separation Minimum airspace.***

(a) Except as provided in paragraph (b) of this section, no person may operate a civil aircraft in airspace designated as Reduced Vertical Separation Minimum (RVSM) airspace unless:

(1) The operator and the operator's aircraft comply with the minimum standards of appendix G of this part; and

(2) The operator is authorized by the Administrator or the country of registry to conduct such operations.

(b) The Administrator may authorize a deviation from the requirements of this section.

§180 *Rote/Understanding:* Operations within RVSM airspace is limited to very advanced turboprop and jet aircraft. Flight crew training will include a thorough review of RVSM operations and procedures.

§91.181 ***Course to be flown.***

"Unless otherwise authorized by ATC, no person may operate an aircraft within controlled airspace under IFR except as follows:

(a) On an ATS route, along the centerline of that airway.

(b) On any other route, along the direct course between the navigational aids or fixes defining that route. However, this section does not prohibit maneuvering the aircraft to pass well clear of other air traffic or the maneuvering of the aircraft in VFR conditions to clear the intended flight path both before and during climb or descent.

§181 *Rote:* Stay on the centerline, but don't run into anybody.

Understanding: IFR pilots and VFR pilots must avoid each other.

Application: Keep the needle centered; and look outside if you are in VMC.

Correlation: GPS courses are linear. They can be accurate to within .001 nm or six feet. VOR radials get less sensitive as you get farther away. One dot deflection at about 30 nm is over a mile across, but at one DME it is only 100 ft wide. This is why holding patterns at intersections far from the VOR might be completed without exceeding half a dot on the primary course. This difference between linear and radial courses require different techniques to keep the needle centered.

VOR course transmissions are slightly ambiguous. There are two error sources for VOR navigation: The transmitter – up to two-degrees, and receiver – up to six-degrees.

Direct GPS routes do not always overlay Victor airways. A course deviation of half a mile can be quantified on GPS receivers, but OBS deviations relate to degrees.

§91.183 ***IFR communications.***

Unless otherwise authorized by ATC, the pilot in command of each aircraft operated under IFR in controlled airspace must ensure that a continuous watch is maintained on the appropriate frequency and must report the following as soon as possible—

(a) The time and altitude of passing each designated reporting point, or the reporting points specified by ATC, except that while the aircraft is under radar control, only the passing of those reporting points specifically requested by ATC need be reported;

(b) Any unforecast weather conditions encountered; and

(c) Any other information relating to the safety of flight.

§183 *Rote:* Tune in and Listen up,

Application: Be ready to make each report when required. Directions for making reports required by (a) above are found in AIM 5-3-2. ID, Position, Time Altitude Type flight plan if not talking to ATC, Estimate of your next fix, Name of the succeeding fix (I PTA (T) EN). When you are asked to "Report OED" you can fill out most of it before you get there, then fill in ATA and ETA and call. (77B, OED at ____, 7000, (T), RBG at ____, EUG)

Correlation: Report: designated points only in non-radar, PIREPS for unforecast weather, and anything relating to the safety of flight.

Required reports are listed in §91.183 and §91.187. However, there is a list contained in AIM paragraph 5-3-3 that might fall under "safety of flight."

5-3-3. Additional Reports The following reports should be made to ATC or FSS facilities without specific ATC request:

1. At all times.

(a) When vacating any previously assigned altitude for a newly assigned altitude.
(This allows ATC to legally use that altitude.)

(b) When an altitude change will be made on a clearance specifying VFR−on−top.

(c) When unable to climb/descend at a rate of at least 500 feet per minute.

(d) When approach has been missed. (Request appropriate clearance …)

(e) Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (whichever is greater) from that filed in the flight plan.
(This allows controllers down the line to plan for your arrival.)

f) The time and altitude when **reaching** a holding fix or point to which cleared.
("Reaching," not "Established." ATC needs to know when you are stopping, not just when you are finally satisfied with your holding pattern.)

(g) When leaving any assigned holding fix or point.

NOTE− **(disregard. Note is for military pilots)**

.

(h) Any loss, in controlled airspace, of [applicable nav/comm equipment] …

(i) Any information relating to the safety of flight.

2. When not in radar contact.

(a) When leaving final approach fix inbound on final approach. …

(b) A corrected estimate at any time ETA is in error in excess of 2 minutes. …

b. Pilots encountering unforecast or hazardous weather conditions.

There is a bit of forgotten etiquette regarding compulsory or requested reports: If they have picked you up on radar, they are expecting you, and expect you to report only your altitude. But if they don't, you will need to make the full report. But you don't know which. The traditional protocol is for you to say only your ID and the name of the fix ("77B FORTUNA"). They will either say "Go ahead" to hear the complete report, or, "Roger, say your altitude."

§91.185 ***IFR operations: Two-way radio communications failure.***

(a) *General.* Unless otherwise authorized by ATC, each pilot who has two-way radio communications failure when operating under IFR shall comply with the rules of this section.

(b) *VFR conditions.* If the failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, each pilot shall continue the flight under VFR and land as soon as practicable.

(c) *IFR conditions.* If the failure occurs in IFR conditions, or if paragraph (b) of this section cannot be complied with, each pilot shall continue the flight according to the following:

(1) *Route.* (i) By the route assigned in the last ATC clearance received;

(ii) If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance;
(iii) In the absence of an assigned route, by the route that ATC has advised may be expected in a further clearance; or
(iv) In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance, by the route filed in the flight plan.

(2) *Altitude.* At the highest of the following altitudes or flight levels for the route segment being flown:

(i) The altitude or flight level assigned in the last ATC clearance received;

(ii) The minimum altitude (converted, if appropriate, to minimum flight level as prescribed in §91.121(c)) for IFR operations; or

(iii) The altitude or flight level ATC has advised may be expected in a further clearance.

(3) Leave clearance limit.

(i) When the clearance limit is a fix from which an approach begins, commence descent or descent and approach as close as possible to the expect-further-clearance time if one has been received, or if one has not been received, as close as possible to the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route.

(ii) If the clearance limit is not a fix from which an approach begins, leave the clearance limit at the expect-further-clearance time if one has been received, or if none has been received, upon arrival over the clearance limit, and proceed to a fix from which an approach begins and commence descent or descent and approach as close as possible to the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route.

§.185 (c)

Rote:

1. Route:	**2. Altitude:**
Assigned	Assigned
Expected	Minimum IFR altitude
Filed	Expected – [NOT *FILED* ALTITUDE]

Understanding: If no EAC has been received, leave Clearance Limit as close as possible to your ETA calculated from the filed Estimated Time Enroute filed on your flight plan.

Scenario: Your flight has gone as planned to this holding point. Your ETE began when you were cleared for takeoff. "Oh yeah, when did we take off? OK, got that, but 1356 plus 3:45 is . . ."

Now is not the time to add minutes and hours. Avoid this problem by planning to be late. File your ETE using your whole route at cruise speed. (but carry enough fuel for all anticipated delays).

§91.187 ***Operation under IFR in controlled airspace: Malfunction reports.***

(a) The pilot in command of each aircraft operated in controlled airspace under IFR shall report as soon as practical to ATC any malfunctions of navigational, approach, or communication equipment occurring in flight.

(b) In each report required by paragraph (a) of this section, the pilot in command shall include the—

(1) Aircraft identification;

(2) Equipment affected;

(3) Degree to which the capability of the pilot to operate under IFR in the ATC system is impaired; and

(4) Nature and extent of assistance desired from ATC.

So, "What are the "legally" required reports?"

- Designated or Requested reporting points,
- Unforecast weather, (PIREP)
- Any other information relating to safety of flight.
- Malfunction of navigation or communication equipment.

The three remaining sections: **§.189, §.190** and **§.191** all pertain to Category II and III operations. We will leave those for the training you will receive for your transition to properly equipped airplanes.

SUFFIX

Now that you have had instruction in reading the official government rules, you can practice on this example of a revision of Part 91 submitted by the author. (The comment period has long since expired with no response.)

Federal Aviation Administration

NOTICE OF PROPOSED RULEMAKING (NPRM)

14CFR Part 91.001(a)(3).

(i) Except as provided in Section (iv) of this section, no pilot or pilots, or person or persons acting on the direction or supervision of a pilot or pilots, may try or attempt to try or conspire to make an attempt to try to comprehend or understand any or all of the herein mentioned Aviation Regulations, in whole or in part except as authorized by the Administrator or an agent appointed by or inspected by the Administrator.

(ii) If a pilot or group of pilots becomes aware of, or realizes, or detects, or discovers, or otherwise finds that he or she or they, are, or have been beginning to understand the aforementioned Aviation Regulations, he, she or they must immediately, within five (3) days of this realization, notify the Administrator in writing.

(iii) Upon receipt of the above-mentioned Notice of Impending Comprehension, the Administrator or his designated representative shall immediately amend the applicable Aviation Regulations in such a manner so as to eliminate any further comprehension hazards.

(iv) Except as provided in 14CFR Part 91.3, the Administrator may, at his or her discretion, require the offending pilot or pilots to attend remedial instruction on Aviation Regulations at an FAA Approved School until such time that the pilot or pilots is/are too confused to be capable of understanding anything.

Please submit comments on the proposed rule in quadruplicate to:

FAA Office of Bureaucratic Jargon
13125219 General Billy Mitchell Drive
Washington D.C. 21020-8977521

The deadline for said comments was December 31, 1998.

Now back to seriousness.

Turn left to intercept Final