Stan/Eval Newsletter
CIVIL AIR PATROL
UNITED STATES AIR FORCE AUXILIARY
105 S. Hansell Street
Maxwell AFB, AL 36112

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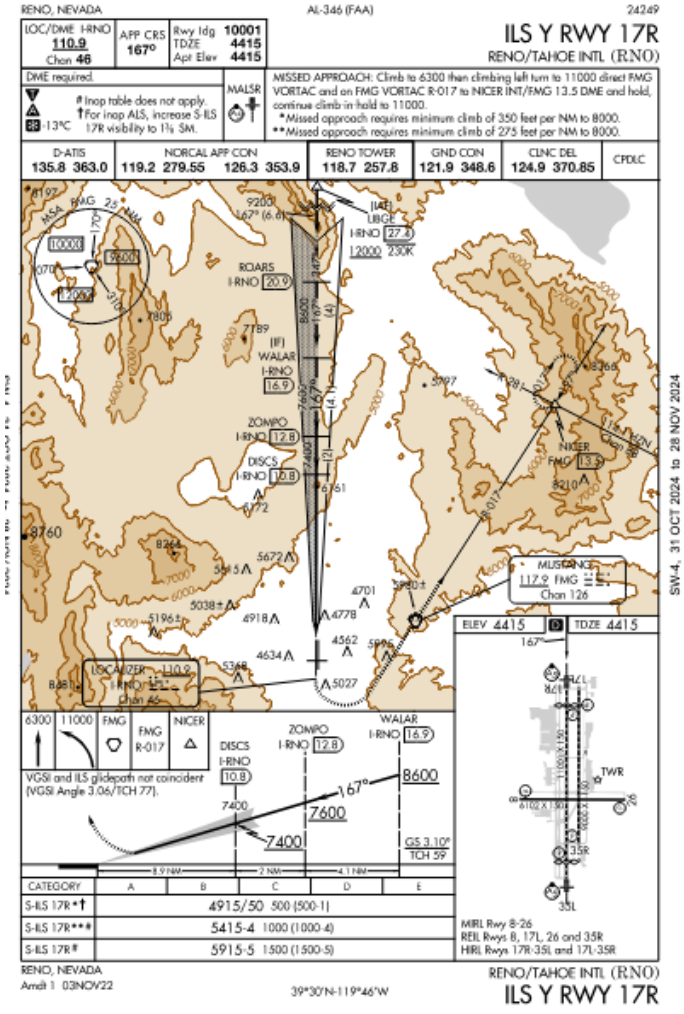
Which Minimums do I use?

Most approaches that we fly have various minimums depending on whether you are using a glide slope, localizer, or doing a circle to land. For example, an ILS will have one set of minimums while the LOC will have another, and the circling approach may have something different as well. However, there are some approaches where you may have different minimums for the same approach as the following approach (ILS Y 17R to Reno, Nevada KRNO).

Looking at the bottom of the plate, we see some interesting things. Note there are no LOC or Circling minimums. Only an ILS is authorized. Hmmmm…. that might tell you something.
Another interesting characteristic is that there are three minimums listed which may at first be a bit confusing. The first ILS listed has a decision altitude (DA – no, a DA is NOT a minimum!) of 4,915' and visibility (yes, visibility IS a minimum) for 5,000' RVR. The second has a DA of 5,415' and visibility of 4 miles. While the last has a DA of 5,915' and 5-mile visibility. If you look at the height above touchdown (HAT) for each, you need VFR weather to use the last two. The second one has a HAT of 1,000' and 4 miles while the last has 1,500' and 5 miles. Only the first allows

IMC (500’ HAT and 5,000’ RVR). So, why not choose the first set of minimums? Wouldn’t that increase your chances of completing the approach and landing?

The answer is in the fine print and is driven by the requirements of the missed approach. KRNO is at 4,415’ altitude. So on a hot day, you can have a very high-density altitude greatly reducing your rate of climb. With the lowest DA of 4,915’, you are almost 1,000 feet below the terrain as you turn to the east on the missed. You need a good climb rate to get out of the hole the ILS has put you in. The fine print tells you that in order to go missed, you need to climb at a rate of 350 feet per nautical mile (fpnm). That’s not fpm. Let’s assume that you had a headwind on the ILS. When you turn on the missed that quickly, it turns into a tailwind. This makes your climb rate in fpnm go down dramatically. If you are in a C182 at 90 KIAS, you will need to climb at rate of probably (depending on winds) of at least 700 fpm to 8,000’! That’s hard to do on a cold day and probably not possible on a hot day, especially if you are heavy. Note that although your KIAS might be 90, with the high-density altitude, your ground speed may be considerably faster.



Just looking at the approach, you can see KRNO is down in a hole surrounded by high terrain. The missed approach conveniently turns you right into high terrain (you like a challenge, correct?). So, the climb rate on a missed is critical to keep you alive. That’s why they have multiple DA’s and visibility requirements. If you are in your heavily loaded pokey C172, you should choose the highest DA of 5,915’ and visibility of 5 miles. Note that as you start your missed, your DA is roughly as high as the highest obstruction. Your climb rate can be anemic, and you will still survive.

Most IFR approaches are straightforward, however some require a bit more study. It’s not only helpful to understand the procedure itself, but also why the procedure was designed the way it is. In this approach, the ability to climb out of terrain is driving the DA and the minimums. Once you understand that, then it starts to make sense, and it is easier to stay out of trouble.

Be careful out there!!!

Shooting an ILS or VOR approach when GPS is FUBAR

We've had several articles on the possibility of losing GPS for various reasons. One could be a national emergency where the Air Force arbitrarily turns GPS off to deny navigational access by unfriendly agents. (The Air Force regularly does exercises sans(without) GPS in what they call "A Day without Space".) As we've seen, especially in the Middle East, jamming and spoofing can render GPS unreliable and is becoming more prevalent. Worst still, the GPS may give you false navigational information with no hint that something is wrong.

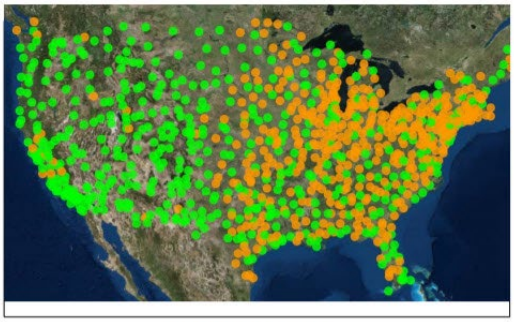
The FAA has an answer. We have previously discussed the MONS approach (Minimum Operational Navigational System) which relies on a network of VOR's and DME to give you a basic navigational capability sans GPS and even support ground-based approaches. Those who wish for the "Good Old Days" will love it, as it will be like what we had in the 1950's. What's not to like? If you want to review what MONS is all about, the FAA has a good overview here.

Recall that for an IFR flight (if no alternate is required) you must be able to fly to your destination, fly the approach, and have a 45-minute fuel reserve. If an alternate is required, you need to fly to your destination, shoot an approach, fly the missed, fly to your alternate, and shoot the approach with a 45-minute reserve. That can be a lot of fuel in some cases.

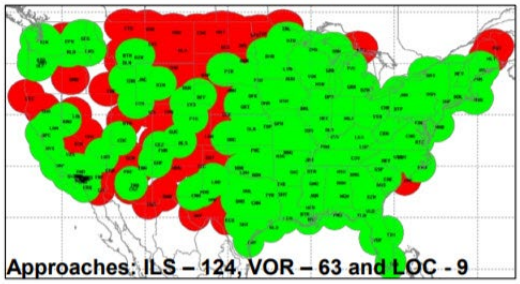
What if we take off with GPS operational and sometime during flight GPS is deactivated? Our destination and alternate are probably no longer practical unless they are MONS airports. With no GPS, you have no guarantee you can fly to your original alternate. Now we must fly to a MONS airport, conceivably go missed there, and travel to yet another MONS airport. This may not be possible without running out of fuel. MONS airports are few and far between. If GPS is inoperative before we depart, our planning now must be restricted to MONS airports but at least we know and we can carry the proper fuel reserves.

With the proliferation of GPS LPV approaches, we get used to WAAS minimums. MONS will offer an ILS at best, and a VOR at worst. A MONS airport is only guaranteed to have at least a VOR approach. ILS only if you are lucky. Yeah, 1950's flying.

CONUS Candidate Discontinued VORs & MON Airports



MON Airports



MON airports ensure that an aircraft is within 100 nm of a location where an LOC, ILS or VOR approach may be flown.

Retained VORs (587*)

Target Discontinued VORs (309*)

VOR MON Discontinuance Target	
Service Area	**# Discontinued**
Western	15
Central	162
Eastern	132*
Total Target	**309***

**Atlanta (ATL) VORTAC has been added to the Target Discontinuance List and removed from the MON (Retention) List.*

VOR Configurations (as of October 2017)				
	Retention Target	Discontinuance Target (Remaining)	Current Total	Total Discontinued
VOR	17	11	28	1
VOR/DME	213	146	359	9
VORTAC	357	136	493	6
Total	587	293	880	16

Another consideration is flying the approach to a MONS airport sans GPS. We have become accustomed to using GPS to get us on the approach before we switch to the green needles but now, we must use VOR's to do that. Here you are, up in the sky, and not a magenta line in sight. Yikes! Situational awareness will be much tougher as you won't have that moving map anymore. Just squiggly green lines that tend to move around a lot. Yeah, 1950's flying.

If you are like me and practice green needle approaches as well as GPS approaches, you may want to navigate to the approach using green needles instead of just shooting the approach with them. It's not that hard, but if you haven't done that since your IFR check ride, you'll find it a bit of a fun challenge.

Note we have considered MONS as it applies to CAP, but really to most GA aircraft as well. More sophisticated aircraft that have Flight Management Systems will not only use the VORs but also DME/DME coupled to an inertial navigational system. That will put in them in the 1980's but they will still miss GPS. You and I will be constrained to the 1950's.

Fly safe!

CAP Flight & Mission Envelope (LtCol J. Vallone NVWG)

CAP pilots that know the limits of the aircraft and fly within the prescribed limits assure themselves a margin of safety. That margin was built into the design of the airplane by the manufacturer and then published in the flight manual (Pilot Operating Handbook) for the benefit of pilots. If you are not familiar with the flight envelope of your aircraft, review the manual to learn or refresh your memory on the airframe and flight limitations.

That's one flight envelope, however there is another that I would encourage you to examine. The other envelope is more complex and more personal for each CAP pilot, flight and CAP mission. It's the one you construct. Let's call it the CAP Mission Envelope. The CAP Mission Envelope is the combination of standards or limits that each pilot needs to assemble to remain safe. Pilots stay safe by identifiing in advance the specific flight, weather, aircraft and personal limitations for each flight.

Looking at specific examples will help clarify the details of this second envelope for safe flight. If it's pouring rain with a low freezing level and you have a VFR aircraft not suitable for flying in icing conditions or IFR weather and you are not rated to fly IFR; the decision not to fly that day is easy. No prudent pilot would attempt it - too risky. Let's progress from that easy decision to other decisions.

Assume we have a day with good visibility, high ceilings, a 14-knot direct cross wind, and a 1,500-foot broken ceiling later in the day. The pilot plans to fly a CAP C-182 G-1000 with a 15-knot crosswind limitation. OK so far? Maybe.

The pilot has not flown for 60 days and will be flying with a CAP observer and scanner, both unfamiliar with the aircraft. They might have lots of questions, which could be a distraction during the mission. In addition, the pilot has 15 hours in the airplane acquired over two years with total flight time of 1,200 hours over 40 years. He has a Private Pilot Certificate and an instrument rating completed 6 years ago.

What do you think? Does this pilot fall within the confines of the CAP Mission Envelope? The additional data indicates the flight might represent one that would challenge, if not exceed, the pilot's proficiency as well as his comfort level. Is such a flight FAA or CAP legal? Looking at minimum standards it may be. Is it prudent? Probably not. The risk factors will vary from pilot to pilot, but you see the challenge.

Mission Factors

The CAP Mission Envelope is not a hard and fast set of weather minimums, looking only at ceiling, visibility or even winds. It involves much more. Criteria, such as the amount of sleep the pilot had and pressures from work, can significantly contribute to the safety of the flight. They relate to the pilot's ability to focus on the CAP mission and complete it safely. Add a headache, hasty preparation, last minute rushing to fly, short window to complete the flight and other issues. Do you think you'll have a potentially hazardous flight?

The USAF has constructed a model to help quantify these intangible threats to a safe flight. The USAF, after years of mishap data collection and analysis, concluded that four out of five causal

factors were related to human factors. The concept of Operational Risk Management was instituted by the military and adopted by the Civil Air Patrol. Conclusion: human factors are very relevant to safety.

CAP Mission Envelope means the flight must have some operational significance. Flying over the desert to photograph fire damage can be a mission. The message here is that preparation and making certain the aircraft and pilot are mission capable are essential. Flights are safer if there is a defined purpose and direction. The CAP aircrew defines those goals and limits.

Defining Your CAP Mission Envelope
In applying the concept of a CAP Mission Envelope to your flights there are some guidelines that can make the process integrated into your flying habits.
1. Define the mission
2. Confirm aircraft capability
3. Confirm pilot capability
4. Set external standards
5. Define abort standards and procedures

Defining the mission: Why are we flying? What will we accomplish? Define it and the limits.
Aircraft capability: Did we consider takeoff data in hot weather or high elevations, landing in winds or low forecast ceilings, fuel duration and overall mechanical condition.
Pilot capability: Pilot capability is subjective. Poor weather conditions or system emergencies can surprise a pilot. Pilot readiness is worth examining thoroughly. Come up with your own personal standards.
External standards: Flights densely populated airspace, high-traffic airspace are areas where inexperience pilots may have challenges. Complex radio calls and arrival procedures all constitute what I label as external factors. They exist but can be easily avoided.
Abort standards and procedures: One of the maneuvers that I don't think is practiced frequently enough is the simple go-around. If you always land, regardless of alignment, speed, position down the runway you may be letting standards slide. Going around is OK. The most experienced pilots I have flown with go around more frequently than lesser experienced pilots.

CAP missions can be complex and challenging for even the most experienced mission pilots. By staying within the limits of the aircraft flight envelope and the Mission Envelope we can safely complete our Civil Air Patrol mission objectives.

Airspace Back to Basics
Understanding all the complexities of airspace when flying is why many people get their instrument rating. If you fly IFR, you don't need to know about what could be a complex subject! ATC takes care of all that and you can fuhgeddaboudit. However, if you are VFR or even IFR in uncontrolled airspace (a subject for another time), you need to know the basics. So, let's do a little review. For a complete description refer to Chapter 3 of the AIM.

Simplistically, airspace falls into two worlds – controlled and uncontrolled airspace. If you are in uncontrolled airspace, it's all up to you and ATC won't be much help (although you can always ask). There are no firm rules on why some airspace is uncontrolled but one of the factors is

whether ATC radars can “see” into that airspace. If not, then it’s probably going to be uncontrolled (lots of exceptions here). There are other factors as well. ADS-B may well be a technology that makes the FAA rethink what is controlled and uncontrolled but that is far into the future. You can also add “special use airspace” and “other” to controlled and uncontrolled, more on that later.

Controlled airspace is airspace that is the responsibility of ATC to manage. There is plenty of controlled airspace where you can fly without talking to ATC, so controlled airspace doesn’t mean that you must be talking to ATC or flying IFR. It just means that ATC is managing the airspace.

A few years ago, the US had its own definitions of airspace with Terminal Control Areas (TCA’s). That was replaced by the ICAO definitions that we now commonly use. ICAO defines seven types of airspace designated by the letters A-G. A through F is used for controlled airspace whereas G (think “Government free”) designates uncontrolled airspace. Roughly speaking, the level of control decreases as you go from A to F. F airspace is not used in the US but is used in other countries (although it is rare). So, you can forget about F airspace.

The type of airspace you are flying in defines the visibility required for VFR flight, the equipment you need to have, and a few other things. The following table is from Chapter 3 of the AIM and defines visibility and cloud clearance for VFR flight. If you can’t meet these, then you are IFR.

I have found the following mnemonic to be helpful: C D E Good Night is a handy phrase to recall that the visibility and cloud requirements below 10,000 feet are the same in C D E and G at night. Note also that only G differentiates between night and day. Other mnemonics are:

- Three 152 (aircraft), 3 miles visibility, 1000 above, 500 below, 2000 horizontal for class C, D, E, G (night) below 10, 000 MSL.
- F-111 (airplane), Five miles visibility, 1,000 above, 1,000 below, 1 SM horizontal for class E above 10,000 MSL.

When first studying this, I found it hard to understand “below” and “above” and got them switched around. The best way to keep it straight is to think about how these came about. With the advent of jets, there is the concern of a jet on an IFR flight plan popping out of a cloud. The logic is that jets tend to climb fast ergo you need to be at least 1,000 feet above clouds to be able to see and react, whereas they tend to descend a bit slower ergo you only need to stay at least 500’ below a cloud.

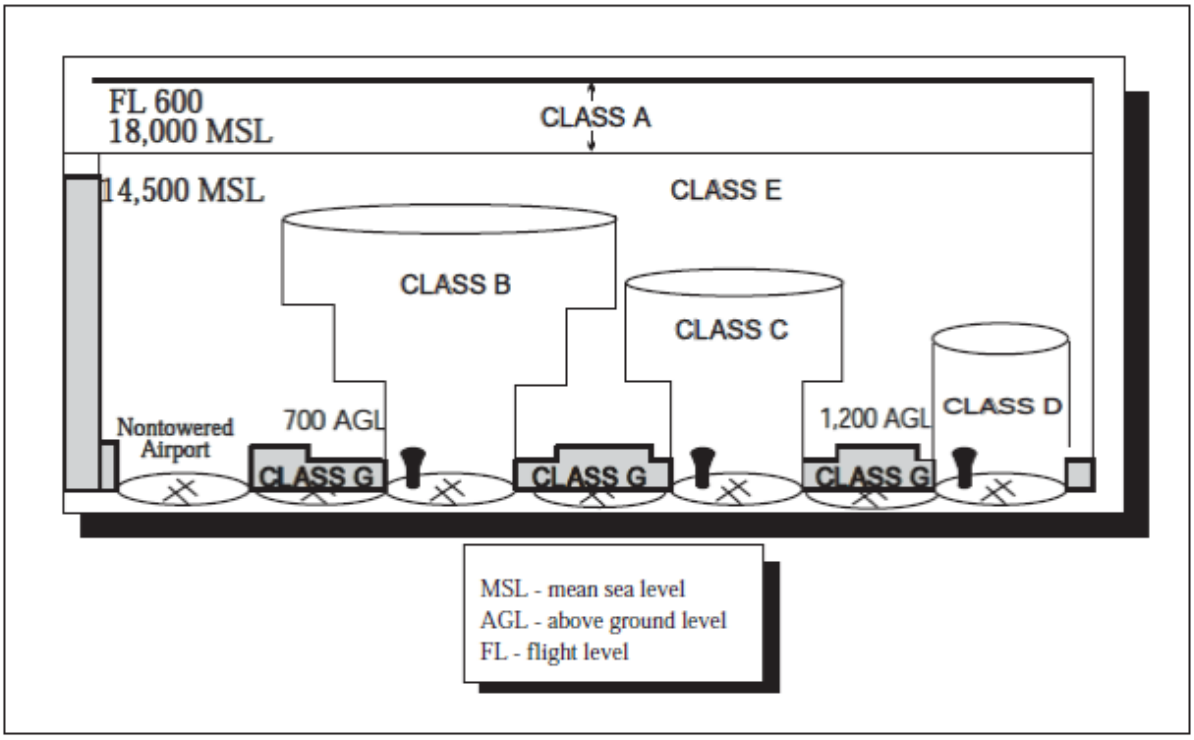
TBL 3-1-1
Basic VFR Weather Minimums

Airspace	Flight Visibility	Distance from Clouds
Class A	Not Applicable	Not Applicable
Class B	3 statute miles	Clear of Clouds
Class C	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class D	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class E Less than 10,000 feet MSL	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
At or above 10,000 feet MSL	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal
Class G 1,200 feet or less above the surface (regardless of MSL altitude).		
Day, except as provided in section 91.155(b)	1 statute mile	Clear of clouds
Night, except as provided in section 91.155(b)	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface but less than 10,000 feet MSL.		
Day	1 statute mile	500 feet below 1,000 feet above 2,000 feet horizontal
Night	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10,000 feet MSL.	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal

The following graphic from Chapter 3 of the AIM depicts the approximate shapes and relationships of the various airspaces. Note that in general, Class B, C, and D are associated with airports. Missing from the graphic is the Class E airspace above FL60, which could be important if you really want to go high for a High Bird Mission in your C182.

Each class of airspace requires different equipage for VFR operations. Class B and C require a two-way radio, Mode C transponder, and ADS-B. Class D requires a two-way radio while Class E and G require no special equipment. However, any aircraft flying within a Class B veil must have a transponder and ADS-B. We will ignore Class A as CAP rarely operates there.

FIG 3–2–1
Airspace Classes



There are also requirements for when you are obligated to talk to ATC. For VFR operations, you must receive an ATC clearance to enter Class B airspace. So, you better talk to ATC! There is no "clearance" in Class C, but you must be communicating with the controller, and the controller must acknowledge you by call sign. However, if they tell you to stay clear of Class C you are obliged to do just that. Likewise, when passing through Class D you must be in communication with ATC.

In all cases, even in Class G, you are expected to contact the tower prior to any airport operation (takeoff, landing, taxi, and so forth). And yes, there are towers for a few airports in Class G airspace.

So how about SFRAs, Warning Areas, and so forth? That's the topic of another article. Be careful out there!

Articles for the National Stan Eval Newsletter
These articles have been written to present ideas, techniques, and concepts of interest to CAP aircrews rather than provide any direction. The articles in this newsletter should in no way be considered CAP policy. We are always looking for brief articles of interest to CAP aircrews to include in this newsletter. CAP has many very experienced pilots and aircrew who have useful techniques, experiences, and tips to share. Please send your contribution to stephen.hertz@vawg.cap.gov. You can view past issues here.