

# En-route Charts, Procedures & FARs



AIR ECHO ALPHA 51, LLC.

The **En-Route** phase of flight is defined as that segment of flight from the termination point of a departure procedure to the origination point of an arrival procedure.

AIM 5-3-4. There are 3 fixed route systems established for air navigation purposes. They are the Federal airways consisting of VOR (low victor airways, high jet routes), NDB (low or medium frequency) and the RNAV route system.

Pilots are expected to fly along airways or, on direct courses between NAVAIDs or fixes defining the route. Airways can be thought of as three dimensional highways for aircraft.

The Highways:

Airways based on VOR or VORTAC NAVAIDs - are depicted in **black** and identified by a "V" followed by the route number (V138)

RNAV only routes are depicted in **blue** and identified by the prefix "T" followed by a three digit number (T302).

## FARs that regulate En-Route Procedures

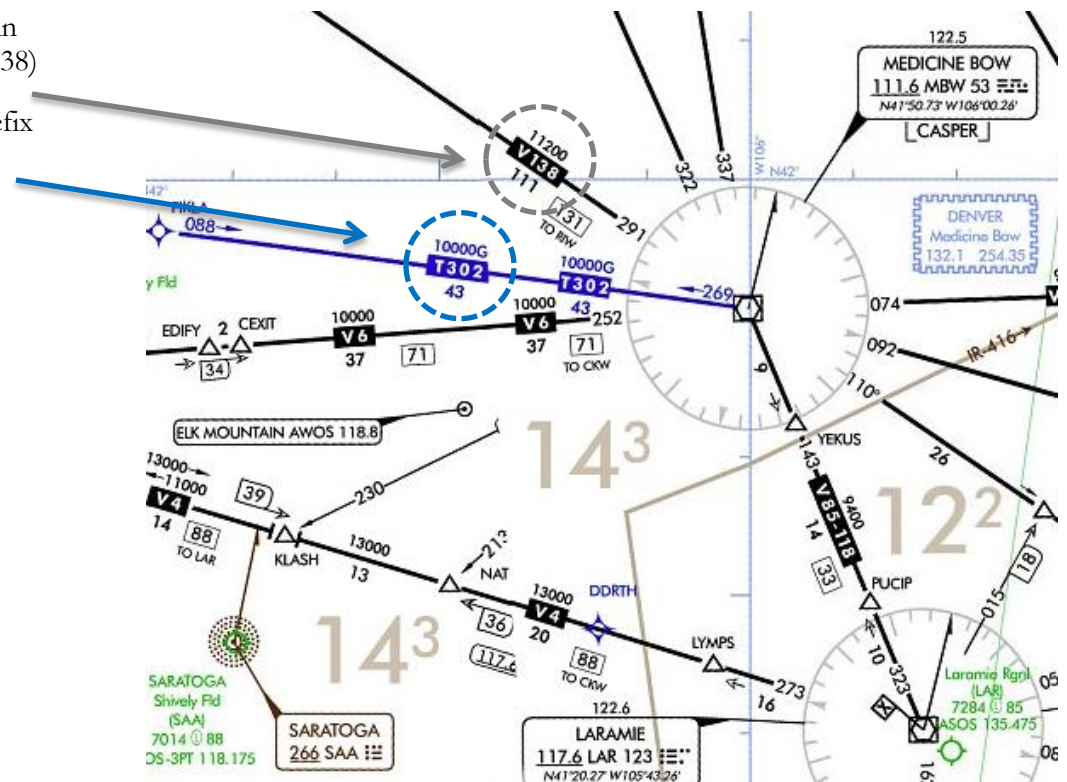
Environment	
FAR/AIM	Description
91.123	ATC instructions
91.169	IFR flight plan
91.173	ATC clearance and flight plan
91.175	TO and LDG in IFR
91.177	Minimum IFR altitudes
91.179	IFR cruising altitudes
91.181	Course to be flown
91.183	IFR two-way communications
AIM 1	Navigation aids
AIM 4	Air traffic control
AIM 5	Air traffic procedures

## FAR 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:

- On an Air Traffic Service route, along the centerline of that airway.
- 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.



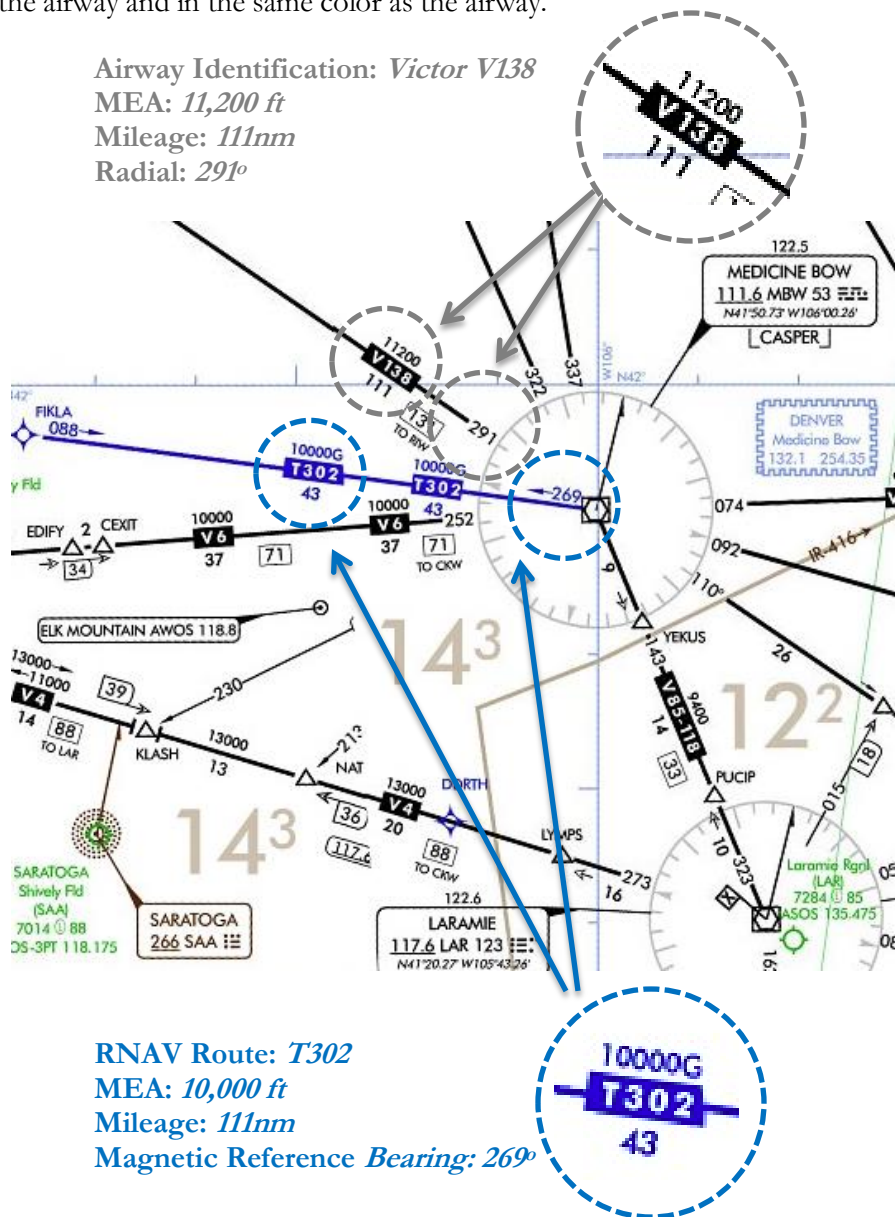
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Airway/route data, such as the airway identifications, bearings or radials, mileages, and altitude (MEA, MOCA, and MAA) are shown aligned with the airway and in the same color as the airway.

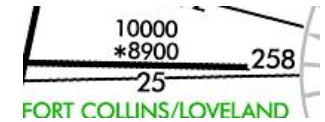
Airway Identification: *Victor V138*  
MEA: *11,200 ft*  
Mileage: *111nm*  
Radial: *291°*



**Minimum Enroute Altitude (MEA)** - The MEA is the lowest published altitude between radio fixes that assures acceptable navigational signal coverage and meets obstacle clearance requirements between those fixes. MEAs are established based upon obstacle clearance over terrain and man-made objects, adequacy of navigation facility performance, and communications requirements.

**Maximum Authorized Altitude (MAA)** - An MAA is a published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment. It is the highest altitude on a Federal airway, jet route, RNAV low or high route, or other direct route for which an MEA is designated at which adequate reception of navigation signals is assured. MAAs are depicted with MAA preceding the altitude “**MAA-00000**”

**Minimum Obstruction Clearance Altitude (MOCA)** - The lowest published altitude in effect between radio fixes on VOR airways, off airway routes, or route segments that meets obstacle clearance requirements for the entire route segment and that ensures acceptable navigational signal coverage only within 25 statute (22 nautical) miles of a VOR. MOCA's are depicted with a “\*” preceding the altitude: **\*8900**



**FAR 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 FAR 95 (IFR Altitudes, MEA, MCA, MOCA, MRA, etc.) and FAR 97 (Standard Instrument Procedure) 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

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## En-Route Climbs on Airways

When should the climb be initiated enroute when there is a change in **MEA**?

There is a change in the MEA en-route from the GLL VOR westbound along V4 from 8000ft to 8400ft at WISER intersection.



Normally, when a change of MEA to a higher MEA is required, the climb may be initiated at the point where the MEA change occurs(WISER).

Standard climb gradient:

SL - 5,000ft: 150FPNM

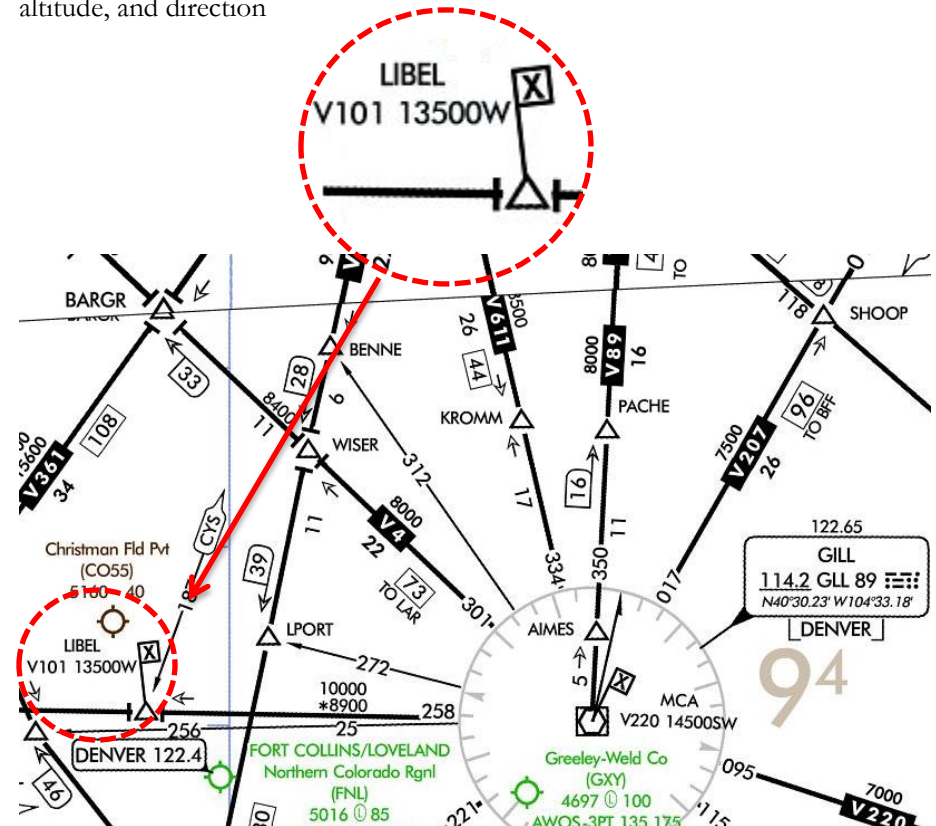
5000ft - 10,000ft: **120FPNM**

10,000ft and above:100FPNM

\* Descend or climb at an optimum rate consistent with the operating characteristics of the aircraft to 1,000 feet above or below the assigned altitude, and then attempt to descend or climb at a rate of 500 feet per minute until the assigned altitude is reached. If at any time the pilot is unable to climb or descend at a rate of at least 500 feet a minute, advise ATC."

When a pilot is approaching steeply rising terrain, an obstacle and/or signal reception is compromised, a **Minimum Crossing Altitude (MCA)** will be established.

A **MCA** is charted as an "X" inside a flag, along with the associated airway, altitude, and direction



If a **MCA** exists, the pilot must initiate the climb **before** the point (LIBEL intersection) where the MEA change occurs. The aircraft must cross at or above the **MCA** at LIBEL intersection.

**FAR 91.177 Minimum altitudes for IFR operations continued.....**

### (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.**



# En-route Charts, Procedures & FARs

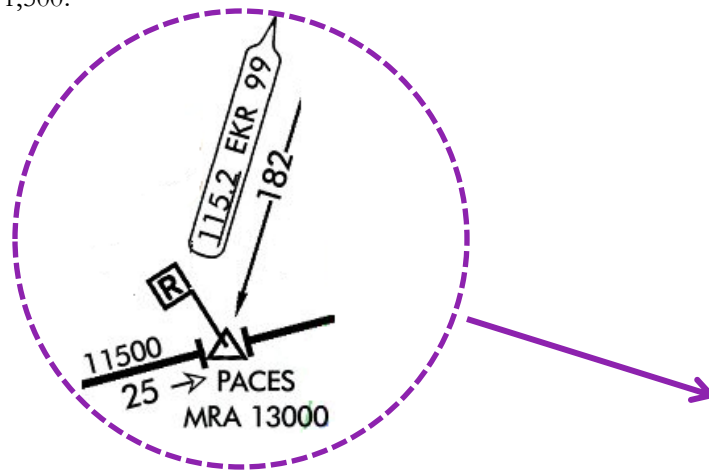


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**Minimum Reception Altitude (MRA)** is determined by FAA flight inspection traversing an entire route of flight to establish the minimum altitude the navigation signal can be received for the route and for off-course NAVAID facilities that determine a fix. When the MRA at the fix is higher than the MEA, an MRA is established for the fix and is **the lowest altitude at which an intersection can be determined**.

An MRA is charted as an "R" inside a flag, along with the associated intersection and altitude.

En-route to Denver from Grand Junction traversing along V134-220-591, in order to identify PACES intersection using the Meeker (EKR) VOR radial 182° the aircraft needs to be at the **MRA** of 13,000ft which is significantly higher than the MEA of 11,500.



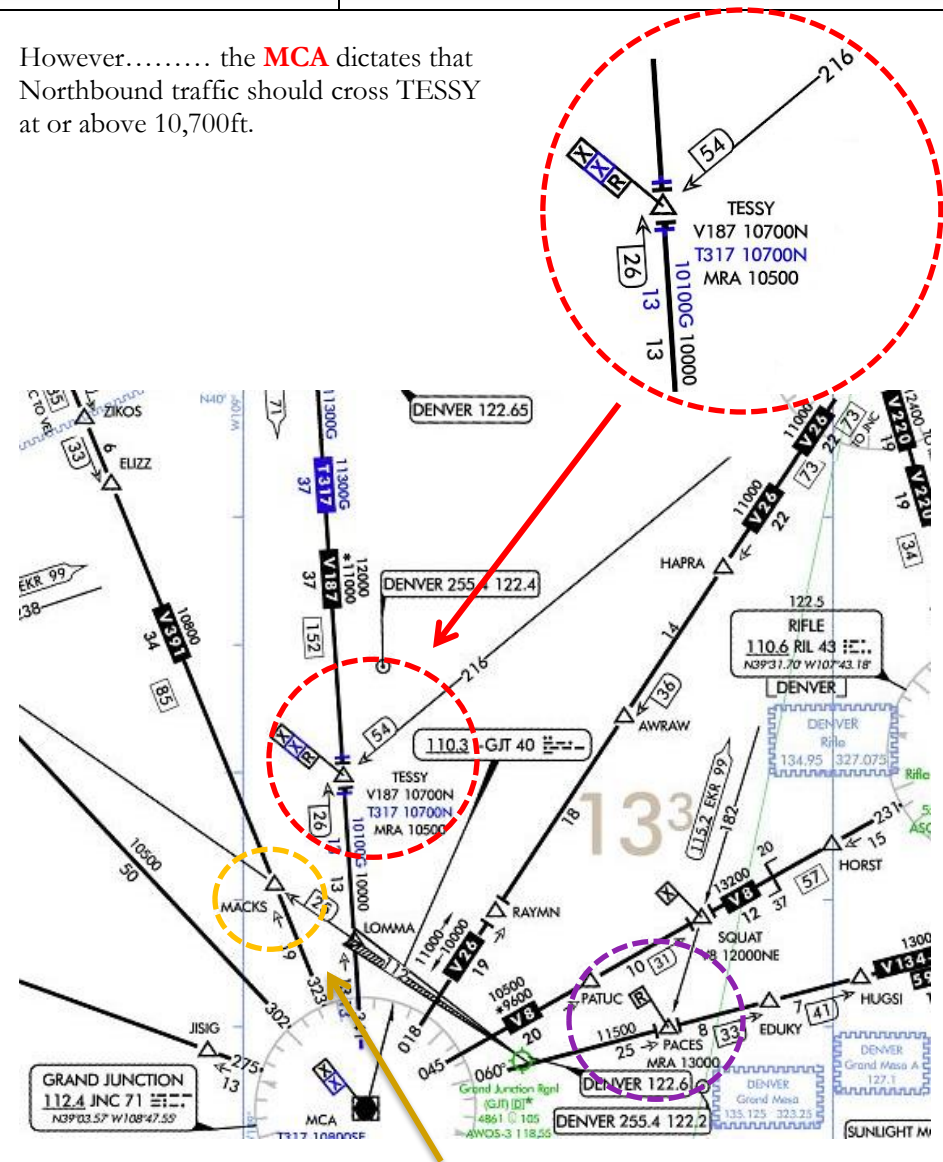
\* The Lines: Thick lines are flyable. Thin lines are used for identification purposes.

\* If you are identifying the intersection by some other means than a VOR, such as DME or GPS, the MRA does not apply to you.

In certain instances the **MRA** is co-located with the **MCA**.

En-route northbound to Rock Springs Wyoming from Grand Junction traversing along V187, in order to identify TESSY intersection using the Meeker (EKR) VOR radial 216° the aircraft needs to be at the MRA of 10,500ft slightly higher than the MEA of 10,000.....

However..... the **MCA** dictates that Northbound traffic should cross TESSY at or above 10,700ft.



In addition to VOR radials, a **localizer or backcourse** can be used to identify an intersection. MACKS intersection is identified using the localizer course from I-GJT on 110.3.

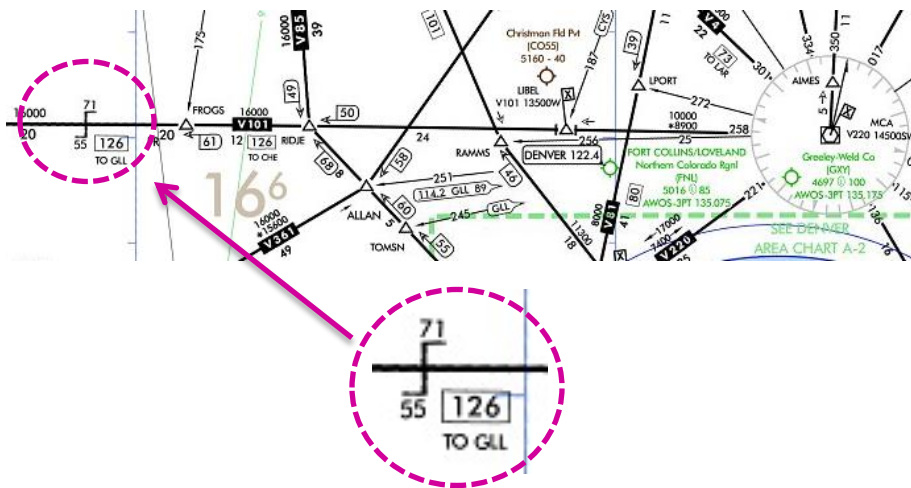
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A Changeover points (COP) ensures proper navigation signal along airways and indicates the **point** where a frequency change is necessary between navigation aids.

AIM 5-3-6. The Changeover point is normally located **midway** between the navigation facilities for straight route segments, or at the intersection of radials or courses forming a dogleg. When the COP is NOT located at the midway point, aeronautical charts will depict the COP location and give the mileage to the radio aids.

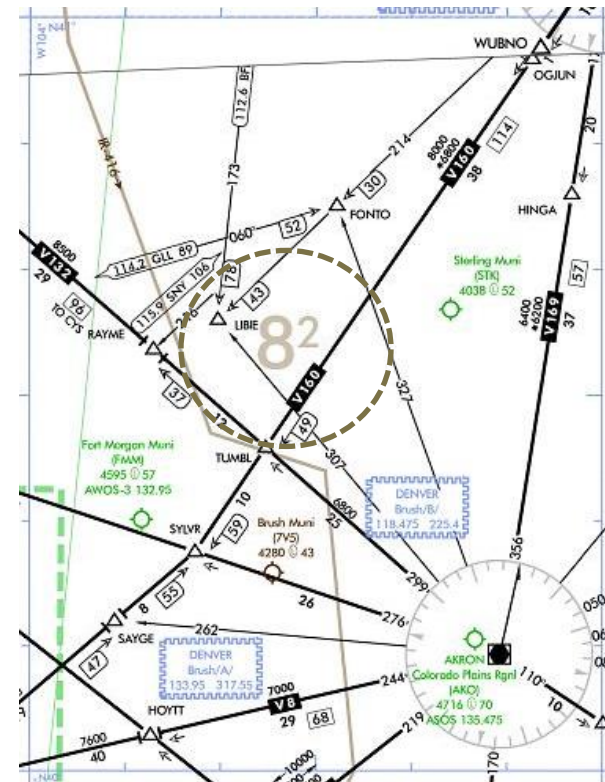


At the COP, the pilot should change the navigation receiver frequency from the station behind the aircraft to the station ahead. En-route from Greeley to Hayden along V101 a COP indicates that the pilot should change the frequency 71 nm from the GLL VOR and 55nm to CHE VOR..

COPs are established for the purpose of preventing loss of navigation guidance, to prevent frequency interference from other facilities, and to prevent use of different facilities by different aircraft in the same airspace.

**Off-Route Obstruction Clearance Altitude (OROCA)** - is an off-route altitude that provides obstruction clearance with a 1,000-foot buffer in non-mountainous terrain areas and a 2,000-foot buffer in designated mountainous areas within the United States. This altitude may not provide signal coverage from ground-based NAVAIDs, ATC radar, or communications coverage.

OROCAs are intended primarily as a tool for emergencies and situational awareness. OROCAs do not provide an acceptable altitude for terrain and obstruction clearance for off-route, random RNAV direct flights.



**FAR 91.177 Minimum altitudes for IFR operations continued.....**

(2) If no applicable minimum altitude is prescribed in FAR 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 ft above the highest obstacle within a horizontal distance of 4 nm from the course to be flown; or
- (ii) In any other case, an altitude of 1,000 ft above the highest obstacle within a horizontal distance of 4 nm from the course to be flown.

# En-route Charts, Procedures & FARs



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## 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 to 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 FAR 91.159.

ACT can assign a pilot an altitude as part of the clearance (CRAFT), as part of a climb via DP, amend altitude en-route due to weather, traffic or sequencing, etc, as part of a descend via STAR, during radar vectors and as part of the IAP.

Close2 pxScratchPadClear

**C** Clearance Limit: Typically the destination airport.

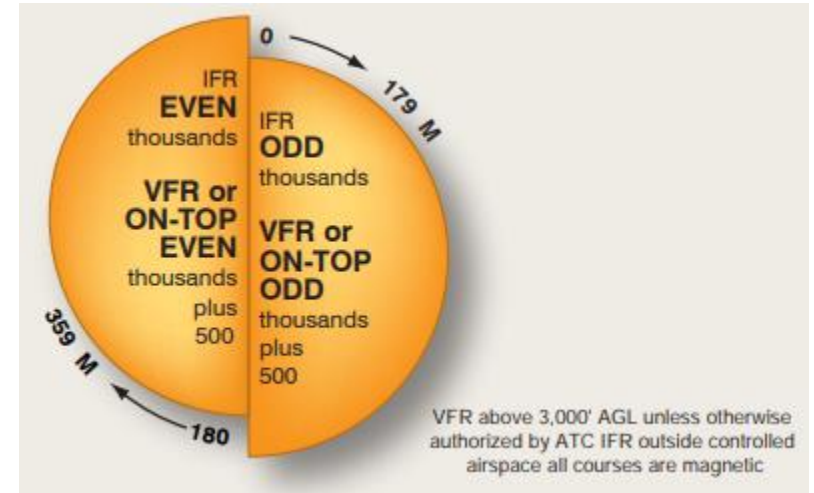
**R** Route: The route you filed, "as filed", or a new route assigned by ATC.

**A** Altitude: The initial altitude you should climb to. A second altitude to "expect" during flight may be included.

**F** Frequency: The frequency used to contact ATC once airborne.

**T** Transponder Code: The 4-digit squawk code used to identify the aircraft on radar.

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## 91.179 IFR cruising altitude or flight level continued.....

### (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).