

U.S. DEPARTMENT OF TRANSPORTATION  
Federal Aviation Administration  
VFR PILOT EXAM-O-GRAM\* NO. 44  
HOW HIGH THE CLOUDS?



Respect most the danger you cannot see!

Analysis of results on FAA written tests reveal that frequently applicants do not properly interpret the height of clouds or ceilings as given in Aviation Weather Forecasts and Reports. Even more often, they are unable to relate these reports and forecasts of cloud and ceiling heights to altimeter indications and safe terrain clearance.

It may well ruin the balance of the day to learn that a written test was failed because of inability to determine the ceiling or to answer questions related to this knowledge, but there are even more serious consequences. General aviation accident statistics reveal that far more serious problems may be experienced if this same lack of knowledge prevails during flight operations.

Though not likely to improve the weather, perhaps the following questions and answers will help to clear up some of the aforementioned confusion.

**TO WHAT IS THE HEIGHT OF THE BASES OF CLOUDS REFERENCED IN AVIATION WEATHER REPORTS, FORECASTS, AND BROADCASTS?**

1. With certain exceptions which will be discussed later, cloud bases, whether they constitute a ceiling or not, are normally reported in feet above ground level.
2. Whenever a cloud base height is specifically designated "ceiling," it will always be with reference to above ground level. Ceiling heights are mentioned in Aviation Weather (hourly sequence) Reports, Area Forecasts, Terminal Forecasts, In-flight Advisories, Transcribed Weather Broadcasts, Scheduled Weather Broadcasts. Also the cloud heights indicated on Surface Weather Charts and Weather Depiction Charts are above ground level.

NOTE: The contractions CLR, SCT, BKN, and OVC have replaced the symbols ○, ⊙, ⊕, and ⊕.

\* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

## Examples (Excerpted)

### Terminal Forecasts

C25Ø BKN 16Z BKN V OVC

### Area Forecasts

20 SCT VRBL BKN TOPS 90

### Hourly Weather Reports

15 SCT M3Ø OVC

### In-Flight Weather Advisories

AIRMET BRAVO 1. ON A LINE  
FRM CRW THRU BKW TO ROA CONDS  
LWRNG IN LGT RAIN & FOG TO  
BLO 1 THSD FT AND BLO 2 MI  
BFR 17Z WITH HIR TERRN OBSCD.  
CONDS CONTG BYD 18Z.

## Decoding:

Forecast ceiling 2500 feet broken variable to overcast above the surface (AGL).

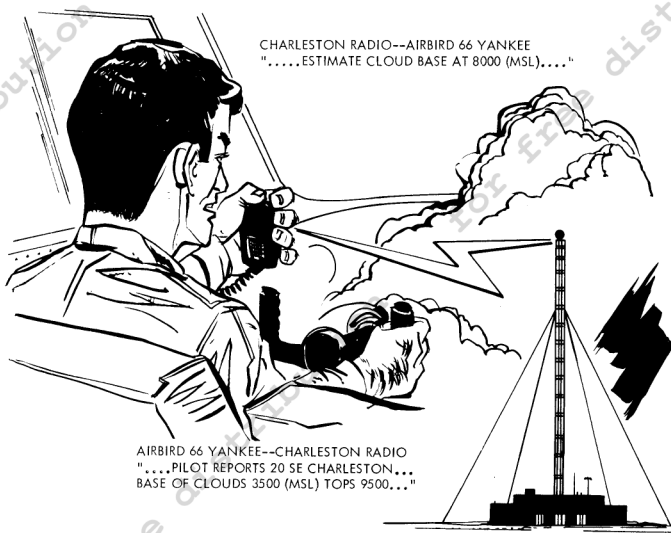
Base of clouds, variable scattered to broken, is forecast to be 2,000 feet above sea level. Tops of clouds forecast to be 9,000 feet above mean sea level (MSL). (Explained further in item 3 of next question.)

Scattered clouds at 1,500 feet (above the surface), overcast ceiling measured at 3,000 feet (above the surface).

On a line from Charleston through Beckley to Roanoke conditions lowering in light rain and fog to below 1,000 feet and below 2 miles before 1700Z with higher terrain obscured. Conditions continuing beyond 1800Z. (Ceilings are expected to be less than 1,000 feet above the surface.)

## WHEN ARE CLOUD HEIGHTS NOT REPORTED IN FEET ABOVE THE SURFACE?

1. UA /OV CRW 13520 1620 FLO55 /TP C210  
/SK 35 BKN-OVC 95 /RM LGT TO MDT RAIN SHWRS



20 miles southeast of Charleston at 1620 GMT, at 5,500 feet, a C-210 pilot reported base of broken to overcast clouds at 3,500 feet, tops at 9,500 feet, light to moderate rain showers.

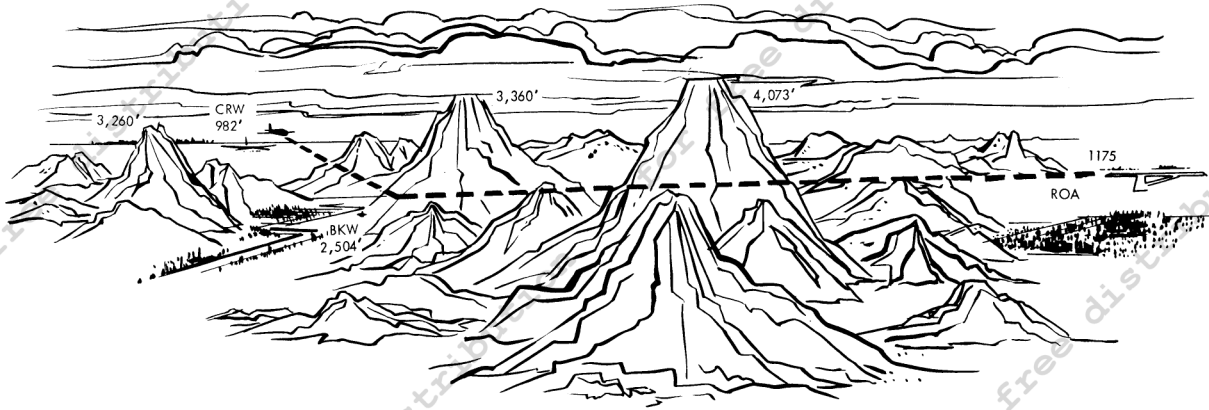
2. As in the preceding example, Pilot Weather Reports (PIREPS) give cloud heights in feet above sea level. Since flight altitudes are normally determined by reading an altimeter set to sea level pressure (MSL), all references to cloud heights are in feet above sea level. It is also true of turbulence, icing, and freezing levels. Note that the specific term "ceiling" is not used in the preceding PIREP.

3. As is the case with PIREPS, all cloud heights in Area Forecasts are normally given in feet above sea level. Such information is usually more useful to the enroute pilot when it is referenced to the same thing as his flight altitude or altimeter indication.

4. Occasionally, however, the height of cloud bases in Area Forecasts will be given in feet above the ground level. Ordinarily "above ground" references will be limited to descriptions of layers sufficiently near the ground to be of appreciable concern to VFR operations and to clouds formed primarily by convection turbulence. In such cases, the exception to the general rule stated in (3) is always noted in the forecast (HGTS ASL unless noted)

5. Although Terminal Forecasts and as previously noted, some Area Forecasts, give cloud bases in feet above the surface, references to cloud tops in Area Forecasts are based in heights above sea level. Terminal forecasts do not include information about cloud tops.

6. References to radar echoes of cloud bases are seldom found in Weather Radar Observations (SD and SD-1), but if they are, both the bases and tops of echoes are referenced to sea level. Of course, radar reports are not to be accepted as proof that cloud bases or tops exist at the exact height indicated by the radar echo.

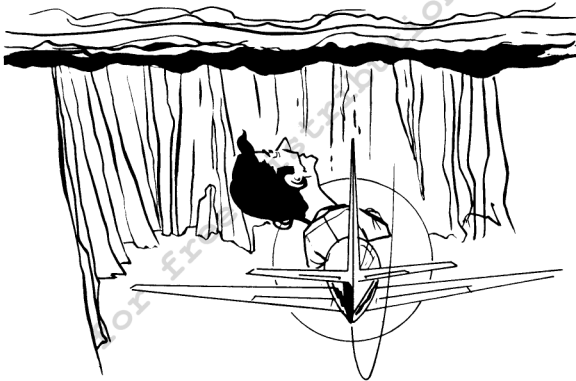


IF CLOUDS AND CEILINGS REMAIN AS GIVEN IN THE FOLLOWING AVIATION WEATHER REPORT EXCERPTS IS VFR FLIGHT FROM CHARLESTON TO ROANOKE VIA BECKLEY POSSIBLE?

Charleston, W. Va. (CRW)	45 SCT	M50	OVC 5	LRG	BI	NOVC	
Beckley, W. Va. (BKW)		M12V	BKN 3	HIR	RDGS	OBSCD	CIG 10V13 BKN V OVC
Roanoke, Va. (ROA)		M18	OVC 3	SUN	DIMLY	VSBL	

1. NOT LIKELY! One cannot say that it is impossible, but in the mountainous country crossed by this flight, it is improbable, indeed. It is even more unlikely that it can be done safely.
2. A check of the illustration above will reveal that Charleston is 982 ft. above sea level, Beckley is 2,504 ft. above sea level, and Roanoke is 1,175 ft. above sea level. On Airway V-258 from CRW to BKW one mountain ridge is approximately 3,260 ft. above sea level. From BKW to ROA, other ridges are 3,360 and 4,073 ft. above sea level. If you were to approach to, or depart from Beckley, flying 500 feet below the clouds as reported above, you would be at an altitude of approximately 3,200 feet.

2504 feet = field elevation at Beckley (MSL)  
 +1200 feet = height of ceiling above the ground at BKW  
 3704 feet = height of clouds above sea level at BKW  
 - 500 feet = clearance below the clouds  
 3204 feet = your flight altitude above sea level.



DIDN'T HE SAY THE CEILING WAS 2500 FEET?

Ignoring the fact that the ceiling at Beckley is only 1,000 ft. at times, 3,204 ft. MSL is 56, 156, and 869 ft. below the tops of the 3 ridges mentioned previously.

3. When evaluated in terms of terrain and the distances between stations reporting weather, this situation obviously precludes any reasonable assumption that all enroute weather is likely to be VFR -- even though all stations report VFR weather. Note carefully that the remarks portion of the Beckley report states that the "higher ridges of the mountains are obscured."

4. Without specific pilot reports on enroute ceilings or other weather conditions, it would be reasonable to assume that clouds might be "on the deck" for portions of this flight.

IS THE PROBLEM DISCUSSED IN THE PREVIOUS QUESTION PECULIAR TO MOUNTAINOUS REGIONS?

No! ! The same problem exists in some measure, at least, in flat, open country - particularly during periods of rapidly changing weather and where there is considerable distance between weather reporting points. It is neither reasonable nor wise to assume that cloud bases along a flight route are uniform in height. Under the circumstances outlined, hourly Aviation Weather Reports alone do not afford enough information upon which to base a prudent decision that the flight can be safely accomplished.

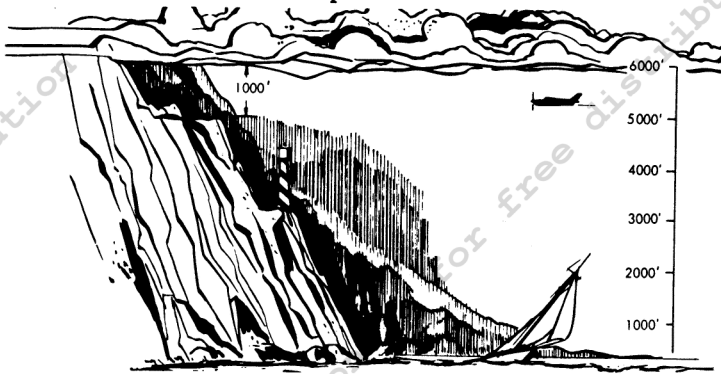
A PIREP INDICATES THAT 27 MILES NW OF ROANOKE VORTAC ON V-258, THE BASE OF THE CLOUDS ARE AT 5,500. DOES THIS REFER TO HEIGHT ABOVE SEA LEVEL OR ABOVE THE GROUND? Refer to the PIREP discussion on page 2 for the answer.

WHAT IS THE APPROXIMATE CEILING AT THE POINT INDICATED IN THE PIREP?

1. Ceiling, by definition, refers to cloud height above the surface. It is impossible to determine height above the surface unless the surface elevation is also known. At the point stipulated in the PIREP, a check of a sectional chart will reveal that the terrain varies between 3,000 feet and 4,073 feet above sea level. Therefore, the ceiling could be anywhere between 2,500 and 1,427 feet.

2. 5500 feet = height of cloud base, MSL	5500 feet = height of cloud base, MSL
-3000 feet = surface elevation, MSL	-4073 feet = surface elevation, MSL
2500 feet = height of cloud base, AGL	1427 feet = height of cloud base, AGL

3. Admittedly, the illustration below is not too typical, but it effectively depicts the problem. Note that in one instance the ceiling is 6,000 feet; in another, it is only 1,000 feet. In fact, toward the left in the illustration the ceiling becomes zero, yet there has been no change in cloud height above sea level! Beware of this trap!



FAA Aeronautical Center  
Flight Standards Technical Division  
Operations Branch  
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Oklahoma City, Oklahoma 73125  
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