Instrument
Study Guide

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INSTRUMENT STUDY GUIDE

How to use this document:

This study guide follows the structure of the ACS and is a supplement to the FAA resources listed in the "References" section at the top of each ACS Task. It is not a replacement for ground training with a qualified instructor. Use this guide in conjunction with the FAA-approved resources to develop a deeper level of knowledge.

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Area of Operation I. Preflight Preparation

Task A. Pilot Qualifications

References: 14 CFR part 61; AC 68-1; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-25

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with requirements to act as pilot-in-command under instrument flight rules.

Knowledge:	The applicant demonstrates understanding of:
IR.I.A.K1	Certification requirements, recency of experience, and recordkeeping.
IR.I.A.K2	Privileges and limitations.
IR.I.A.K3	Part 68 BasicMed privileges and limitations.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.I.A.R1	Proficiency versus currency.
IR.I.A.R2	Personal minimums.
IR.I.A.R3	Fitness for flight and physiological factors that might affect the pilot's ability to fly under instrument conditions.
IR.I.A.R4	Flying unfamiliar aircraft or operating with unfamiliar flight display systems and avionics.
Skills:	The applicant exhibits the skill to:
IR.I.A.S1	Apply requirements to act as pilot-in-command (PIC) under Instrument Flight Rules (IFR) in a scenario given by the evaluator.

- ❏ You logged 1 approach in January, 1 in February, 2 in March, 3 in April, 1 in May, 1 in June, 2 in July, and 1 in August (along with a hold). Each of these approaches occurred on the first of the month. What is the first day that you are no longer instrument current?
  November 1.

- ❏ What privileges did you just lose as of November 1? That is, what were you permitted to do on October 31 that you are now no longer allowed to do until you regain your instrument currency? You can no longer act as PIC under IFR or in weather conditions less than those prescribed for VFR. More specifically, you can no longer: 1) fly in class A airspace, 2) file an IFR flight plan, 3) fly special VFR between sunset and sunrise, or 4) fly in conditions less than basic VFR.

- ❏ How many approaches must you accomplish and log in November to regain your currency? One.

    - ❏ You instead do two approaches in November; now when are you no longer IFR current? January 1 of the following year.

- ❏ What are your options for how to accomplish the approach(es)? They can be done in either an appropriately rated simulator or during a flight with a safety pilot or CFII.

- ❏ Would you be current if you flew the approach(es) by yourself in an AATD? Yes, as long as the approach was conducted in IMC down to minimums and logged.

- ❏ How exactly must an approach be conducted - in both the aircraft and simulator - in order to log and count it toward instrument recency?

  This is detailed in: https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/media/2015/InFO15012.pdf:

  In the plane:

  - If in VMC: you must wear a view limiting device and the approach must be continued in simulated instrument conditions down to minimums. Because you're in VMC and wearing a view limiting device, a safety pilot is required as well, even if you are instrument current already.
  - If in IMC, aka "actual" (while not wearing a view limiting device): you must start the approach and remain in IMC until after the FAF. If you are not already instrument current, you must have a safety pilot who is instrument rated and current, as they would need to be the acting PIC.

  In the simulator:

  - The full approach needs to occur in IMC down to minimums.

- ❏ Your instrument currency is about to expire. Can you take an aircraft up by yourself on a solo flight in clear-sky VMC weather, put on a view limiting device, conduct 6 approaches,

holding procedures, and intercepting/tracking, log it, and maintain currency? Explain. No, you need a safety pilot any time you're wearing a view limiting device in VMC.

- ❏ What qualifications must the safety pilot have? They must be rated in category and class **and hold a current medical.** *(Many people forget the medical part, but 61.3(c) states that a "required pilot flight crewmember" is required to hold a medical certificate, and a safety pilot is required under 91.109.)*

- ❏ What additional qualifications must your safety pilot and aircraft have if you are going to regain currency while flying in actual IMC on an IFR flight plan? The safety pilot needs to be instrument current and the plane needs to be IFR certified/equipped. The safety pilot will need to act as PIC on this flight.

- ❏ How would you log an instrument currency flight with a safety pilot? For example, suppose you flew a few approaches into an airport and John Doe was your safety pilot. It was a 2 hour flight and you were wearing a view limiting device for 1.5 hours. Write "John Doe - Safety Pilot" in the remarks section, and log the number, type, and location of the approaches. You could also add "Holding, intercepting, and tracking per 61.57" in the remarks section. As the pilot-flying, log PIC time for the entire flight length (2 hours).

- ❏ What will the safety pilot log for the flight described above? The safety pilot can log PIC for the duration that the pilot-flying is wearing a view limiting device, but only if the safety pilot agreed to act as PIC before the flight; otherwise, they log SIC time. Assuming the safety pilot agreed to act as PIC (which is generally the expectation, as the pilot-flying can't see outside), the safety pilot will log 1.5 hours of PIC time and write something to the effect of "Safety Pilot for ____" in the remarks. Below is an article describing when you can log PIC: https://www.aopa.org/training-and-safety/learn-to-fly/old-pages/logging-cross-country-time/logging-time-safety-pilot

- ❏ Are you legally required to log all of your instrument approaches? Explain if and when they must be logged. No, not all of them. Logging approaches (as well as flight time in general) is required only 1) when used to establish currency, or 2) to meet checkride eligibility requirements.

- ❏ Say it's January 1 and your IFR currency just expired - this is your first day of not being IFR-current. Going forward, can you always just fly 6 approaches (including holding procedures and intercepting/tracking courses using a navigation system) in order to regain IFR currency? Explain. No, once IFR currency has been lost (in this case on January 1), a 6 month clock starts. Within this 6 month "grace period," IFR currency can be regained simply by completing enough approaches to count 6 of them (along with holding/intercepting) within the preceding 6 calendar months - so in this case, the grace period runs through the end of June.

- ❏ How can you regain IFR currency after June? Satisfactorily complete an Instrument Proficiency Check (IPC).

- ❏ What is an IPC, and who may conduct it? This is a flight check (no required oral portion, although the FAA recommends one) that must consist of at least the areas of operation listed in 61.57(d)(1) - these required tasks are also detailed at the end of Appendix 1 of the IRA ACS. To satisfactorily complete the IPC, the evaluator must ensure the pilot meets the standards in the Instrument ACS.

- ❏ Who is authorized to conduct an IPC? An examiner (DPE); a person authorized by the US Armed Forces; a company check pilot under parts 121, 125, or 135; an authorized instructor (CFII); a person approved by the Administrator to conduct instrument practical tests.

- ❏ What goes in your logbook once the IPC has been satisfactorily completed? An endorsement. Also, the flight must be logged. If an oral took place, that should be logged as well.

- ❏ Can a pilot fail an IPC? Would this failure get entered into IACRA and become part of the pilot's flight record? If ACS tolerances are not met on an IPC, the evaluator simply does not provide the IPC endorsement and logs the flight as a normal instrument training flight. Regarding IACRA, although the FAA encourages pilots to use IACRA to keep track of IPCs, filling out IACRA is not required in order to complete an IPC.

- ❏ Can an IPC be completed in an AATD? An Advanced Aviation Training Device (AATD) can be utilized for the majority of the IPC as specified in the Letter of Authorization issued for the specific AATD. However, the circling approach, the landing Task, and the multiengine airplane Tasks must be accomplished in an aircraft.

- ❏ You haven't flown a plane in a few years. Legally, could you do a couple refresher simulator sessions, take and pass an Instrument Proficiency Check in the plane, then start flying single-pilot IFR? No, you need a flight review to stay current as a pilot. The general pilot currency rules of 14 CFR 61.56 and 61.57(a) still apply! (If passengers are onboard, the 3 takeoffs and landings within the preceding 90 days are also required.)

- ❏ Where can you find the certification requirements for the instrument checkride in the FAR/AIM? 14 CFR 61.65

  - ❏ How about under 141? Part 141 Appendix C. More practically, refer to your 141 syllabus and make sure all prior events in the syllabus have been completed.

- ❏ What is the difference between currency and proficiency? Why do you think recognizing this distinction is important? It's the difference between legality and safety, respectively.

Just because you're current doesn't mean you're safe and proficient. Conversely, just because you're proficient doesn't necessarily mean you're legal under the regulations.

- ❏ What should pilots keep and abide by to ensure *proficiency* - not merely currency - prior to acting as PIC of an airplane? Personal minimums. The FAA provides this Personal Minimums Checklist: https://www.faasafety.gov/files/gslac/courses/content/28/212/Personal%20Minimums%20Checklist.pdf

Task B. Weather Information

References: 14 CFR part 91, AC 91-92; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-25, FAA-H-8083-28

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with obtaining, understanding, and applying weather information for a flight under IFR.

Note: *If K2 is selected, the evaluator must assess the applicant's knowledge of at least three sub-elements.*

Note: *If K3 is selected, the evaluator must assess the applicant's knowledge of at least three sub-elements.*

Knowledge:	The applicant demonstrates understanding of:
IR.I.B.K1	Sources of weather data (e.g., National Weather Service, Flight Service) for flight planning purposes.
IR.I.B.K2	Acceptable weather products and resources required for preflight planning, current and forecast weather for departure, en route, and arrival phases of flight such as:
IR.I.B.K2a	a. Airport Observations (METAR and SPECI) and Pilot Observations (PIREP)
IR.I.B.K2b	b. Surface Analysis Chart, Ceiling and Visibility Chart (CVA)
IR.I.B.K2c	c. Terminal Aerodrome Forecasts (TAF)
IR.I.B.K2d	d. Graphical Forecasts for Aviation (GFA)

IR.I.B.K2e	e. Wind and Temperature Aloft Forecast (FB)
IR.I.B.K2f	f. Convective Outlook (AC)
IR.I.B.K2g	g. Inflight Aviation Weather Advisories including Airmen's Meteorological Information (AIRMET), Significant Meteorological Information (SIGMET), and Convective SIGMET
IR.I.B.K3	Meteorology applicable to the departure, en route, alternate, and destination for flights conducted under Instrument Flight Rules (IFR) to include expected climate and hazardous conditions such as:
IR.I.B.K3a	a. Atmospheric composition and stability
IR.I.B.K3b	b. Wind (e.g., windshear, mountain wave, factors affecting wind, etc.)
IR.I.B.K3c	c. Temperature and heat exchange
IR.I.B.K3d	d. Moisture/precipitation
IR.I.B.K3e	e. Weather system formation, including air masses and fronts
IR.I.B.K3f	f. Clouds
IR.I.B.K3g	g. Turbulence
IR.I.B.K3h	h. Thunderstorms and microbursts
IR.I.B.K3i	i. Icing and freezing level information
IR.I.B.K3j	j. Fog/mist
IR.I.B.K3k	k. Frost
IR.I.B.K3l	l. Obstructions to visibility (e.g., smoke, haze, volcanic ash, etc.)
IR.I.B.K4	Flight deck instrument displays of digital weather and aeronautical information.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.I.B.R1	Making the go/no-go and continue/divert decisions, including:
IR.I.B.R1a	a. Circumstances that would make diversion prudent
IR.I.B.R1b	b. Personal weather minimums
IR.I.B.R1c	c. Hazardous weather conditions, including known or forecast icing or turbulence aloft
IR.I.B.R2	Use and limitations of:
IR.I.B.R2a	a. Installed onboard weather equipment
IR.I.B.R2b	b. Aviation weather reports and forecasts
IR.I.B.R2c	c. Inflight weather resources

Skills:	The applicant exhibits the skill to:
IR.I.B.S1	Use available aviation weather resources to obtain an adequate weather briefing.
IR.I.B.S2	Analyze the implications of at least three of the conditions listed in K3a through K3l, using actual weather or weather conditions provided by the evaluator.
IR.I.B.S3	Correlate weather information to make a go/no-go decision.

IR.I.B.S4 Determine whether an alternate airport is required, and, if required, whether the selected alternate airport meets regulatory requirements.

Weather Sources, Products, and Interpretation*

** Note: per IR.I.B.K1-3, as well as the Skills elements, applicants should show up to their checkrides and EOCs ready to prove that they verified weather using acceptable sources for the full route and duration of the planned flight. Tip: The Graphical Area Forecast (GFA) is an indispensable tool for doing this - it allows pilots to plot their courses, then select for virtually any type of weather while adjusting for the various times and altitudes corresponding to the flight. Be sure to use the "flight path/cross-section" tool (located on the right of the GFA map) in order to show your intended route on the map - this way, you can determine weather in relation to your flight path.*

- ❏ Justify your go/no-go decision. In other words, describe which weather charts you used to plan this IFR cross-country flight and prove that you won't encounter any adverse weather. If there *is* adverse weather and you're making a go decision, explain how you've competently planned around it. Typical charts that applicants use are: Radar Imagery, Surface Analysis, Convective Outlook, Low Level Significant Weather Prognostic, Winds Aloft, METARs and TAFs for all stations along the flight route, Graphical Area Forecast (GFA) charts for the full flight duration and range of altitudes, PIREPs, various icing and freezing level charts.

- ❏ What sorts of enroute weather would lead you to make a no-go decision for this IFR flight? Thunderstorms or any other convective activity, excessive winds (including windshear), excessive turbulence, low cloud ceilings/visibility, icing conditions, heavy precipitation.

- ❏ What are some weather charts and sources you use to verify that you won't encounter any such weather. ** Note: there are many answers to this question - here are some:*
  - Thunderstorms/convection: Radar Imagery, Graphical Area Forecast, METAR/TAF, PIREP, Convective Outlook, Convective SIGMET.
  - High winds: Winds Aloft, Surface Analysis, METAR/TAF, Graphical Area Forecast, AIRMET/SIGMET/Convective SIGMET.
  - Turbulence: AIRMET/SIGMET/Convective SIGMET, Graphical Area Forecast, Low Level Prog.
  - IMC/low cloud ceiling/low visibility: Graphical Area Forecast, METAR/TAF, Low Level Prog, AIRMET Sierra.
  - Icing: Graphical Area Forecast, Icing Forecast, PIREP. Applicants can also piece icing conditions together through the use of Winds Aloft and/or Freezing Level charts to determine freezing level(s), and the Graphical Area Forecast and METARs/TAFs to determine the location of visible moisture.
  - Heavy precipitation: Radar Imagery, METAR/TAF, Graphical Area Forecast.

- ❏ How can pilots determine cloud coverage and visibility beyond the 5 SM range of a TAF? Use the GFA tool. Select the “Weather” tab at the top of the page, then select “Clouds” from the drop-down menu, and adjust the time at the bottom accordingly.

- ❏ What are the three basic types of weather products? Observation, forecast, and analysis.

- ❏ What government agency is the source of weather data and products that pilots should use for preflight planning? The National Weather Service (NWS), which is a sub-agency of the National Oceanic and Atmospheric Administration (NOAA). One component of the NWS is the Aviation Weather Center (AWS), which issues a range of weather products tailored to the aviation community. These products are found on aviationweather.gov.

- ❏ What does the FAA consider to be “approved sources of aviation weather information” for pilots? Per AIM 7-1-3: 1) FAA/NWS sources, 2) Enhanced Weather Information System (EWINS - essentially an FAA authorized, proprietary weather tracking system used by certain commercial flight operations), and 3) commercial weather information providers (although for 121 and 135 operators, commercial products can only be used if they do not substantially alter the government-produced weather information).

- ❏ Can pilots receive a regulatory-compliant weather briefing without contacting Flight Service? Yes.

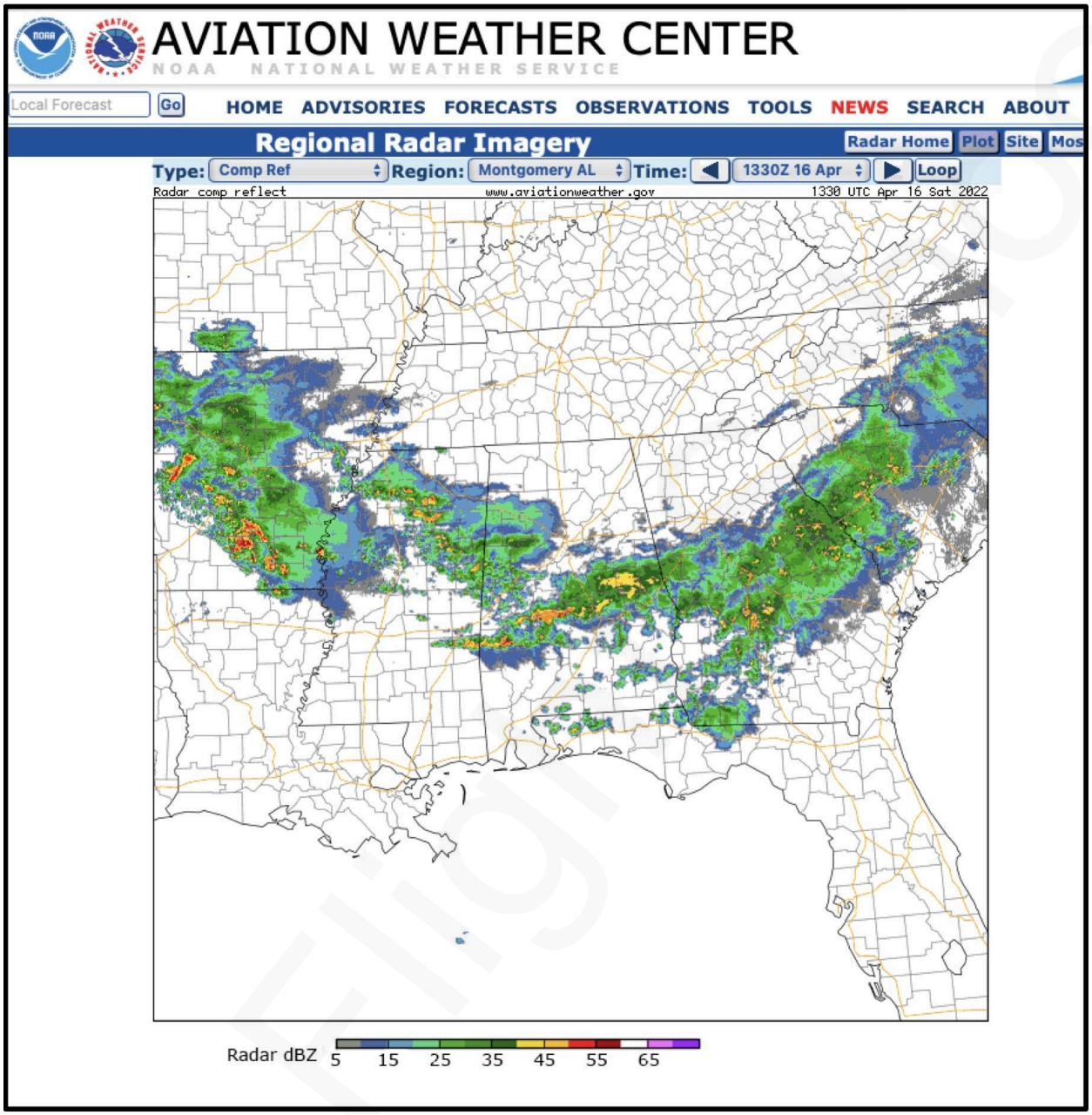
- ❏ Why is it generally best practice (and ATP policy) to contact a weather briefer (FSS) prior to flights? Briefers are the experts. They are qualified and certificated by the FAA to translate pertinent weather and route/NOTAM information and convey it effectively to pilots. Furthermore, using FSS leaves a record that the pilot verified weather and NOTAMs per 14 CFR 91.103.

- ❏ What is meant by the phrase “legal weather briefing”? This is not an official FAA term. Under Part 91, for any IFR flight or flight not in the vicinity of an airport, pilots must become familiar with all available information concerning that flight, including weather reports and forecasts. This can be accomplished legally with a thorough review of pertinent government or commercial weather products. Often pilots use the phrase “legal weather briefing” colloquially to indicate that they used an NWS/FAA source that leaves a record.

- ❏ Is it legal to use non-FAA/NWS-sourced, commercial weather products to verify weather per 91.103? If so, what guidance does the FAA offer for using such weather products/sources? AIM 7-1-3 states: *Pilots and operators should be aware that weather services provided by entities other than FAA, NWS, or their contractors may not meet FAA/NWS quality control standards. Hence, operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for*

example, current weather or forecast weather), the currency of the product (that is, product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar products, or products not supported by FAA/NWS technical specifications. Many new weather products now have a Precautionary Use Statement that details the proper use or application of the specific product. In multiple places, the AIM reminds pilots: *When in doubt, consult with an FAA Flight Service Station Specialist.*

** Note: Extremely basic chart symbology questions have been omitted from the subsequent weather product sections. This should not suggest that examiners will not ask such questions. The focus here is generally on common problem areas.*



- ❏ Are radar images considered to be forecasts, observations, or analyses? Observations.

- ❏ How frequently is a radar image/observation generated, and what is its valid time? They are generated every 4 to 11 minutes upon completion of the radar scan. The valid time is the end of the last radar scan, which is listed on the observation.
- ❏ What type of equipment generates radar observations in the U.S.? Doppler radars - they make up the NEXRAD (Next Generation Weather Radar) system used by the National Weather Service (NWS) and the FAA.

- ❏ How does a Doppler radar work? It sends out a radio signal that reflects (or echoes) off of precipitation. The radar then measures the reflective power (i.e., the amount of backscattered energy) in terms of decibels (dBZ). The higher the reflectivity, the more intense the precipitation. The location of the precipitation is determined by measuring the time the signal takes to return to the radar; the longer the round-trip signal time, the further away the precipitation. Lastly, the "Doppler" part of Doppler radar looks at slight changes in the radio frequency to determine the speed at which the precipitation is moving.

- ❏ What is a radar "echo"? It is the appearance (colors), on a radar display, of the backscattered energy (i.e., reflectivity).

- ❏ Would you expect to encounter the strongest precipitation in the green or pink regions? Pink; as indicated by the key, that represents the highest decibels.

- ❏ What precipitation intensity classifications correspond to each color? Gray and dark blue regions are likely clouds. Light blue through light green is considered LIGHT precipitation. Dark green is MODERATE. Yellow and orange are HEAVY. Red through purple is EXTREME.

- ❏ What information does a radar image provide? Directly, it displays the location and intensity of precipitation. Storm cells, as well as their directions and speed of movement, can also be determined.

- ❏ Are radar echo tops the same as cloud tops? No, echo tops represent the highest altitude containing precipitation. Cloud tops are generally slightly above this.

- ❏ In the image above, Kentucky is all white. Does this mean there are no clouds in Kentucky? No, this chart does not show cloud coverage; it shows precipitation. The colored areas will certainly have clouds, as precipitation needs to fall from something, but the absence of precipitation does not necessarily mean no clouds are present.

- ❏ Name some limitations associated with radar-generated weather products.
  - Precipitation Attenuation: distant precipitation targets may not be displayed accurately on a radar image because closer targets absorb or scatter the radar beam's energy.
  - Range Attenuation: beyond 50 to 75 nautical miles from the radar, the intensity of the radar's beam decreases. Therefore, a distant target will appear less intense than an identical target closer to the radar.
  - Resolution: when multiple precipitation targets are discovered within the same radar beam, they are combined into one echo.
  - Beam Overshoot/Undershoot:
    - Overshoot: some of the Doppler radars that generate radar images are on mountain tops, and the radars don't look down, so any precipitation occurring below the elevation of the radar equipment won't be detected.

    - Undershoot: occurs when the precipitation occurs above the radar beam, usually with high-cloud-based precipitation near the radar site. This often occurs in the western US in the summer.
- Beam Blockage: terrain can block the radar beam.
- Ground Clutter: echo returns from trees, buildings, or other objects on the ground are *usually* automatically removed from the image, but may sometimes be present.
- Wave Propagation (aka sub-refraction or super-refraction): the radar beam is bent and its speed is affected by differences in atmospheric density caused by variations in temperature, moisture, and pressure. This can occur in both the vertical and horizontal directions.
- Anomalous Propagation (AP): this occurs when the radar beam is bent downward enough to hit the ground (aka “ducting”), causing false echoes. Animating the radar image can help differentiate between AP and a thunderstorm. AP blooms up and dissipates, whereas thunderstorms move with a smooth continual motion.
- Ghosts: echoes in apparently clear air caused by a “cloud” of point targets, or by refraction returns of the radar beam in truly clear air.
- Angels: echoes caused by a physical phenomenon not discernible by the eye at the radar site, such as bats, birds, or insects.
- Other Non-Meteorological Phenomena: wind farms and smoke from forest fires can result in beam blockage, false echoes, or high reflectivity values.

❏ What are some additional limitations associated specifically with the Radar Summary Chart? The Aviation Weather Handbook states that tops above 50,000 feet can be disregarded, as they are likely a mistake. Also, this chart is merely a snapshot of the weather at a specific time. Weather changes rapidly and precipitation cells move, so this chart should be considered highly supplemental to any preflight weather briefing.

❏ What is a major concern about flying through a region showing high echo tops? Stronger updrafts, possibly leading to more severe convective activity.

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 (Extracted from FBUS35 KWNO 121354)
FD5US5
DATA BASED ON 121200Z
VALID 131200Z   FOR USE 0600-1800Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000  30000  34000  39000
BIH      9900    2814+05 2820+01 2440-12 2349-25 235741 235951 235952
BLH 3413 2117+19 2124+13 2131+07 2237-08 2339-22 225938 227647 227853
FAT 9900 3105+07 2814+03 2925-01 2535-13 2538-25 244541 244350 254652
FOT 9900 2909+00 2818-04 2930-04 2840-17 2948-27 319040 820547 328353
ONT 9900 2613+12 2519+11 2520+06 2338-08 2345-22 234840 235349 226554
RBL 1709 2013+03 2513-02 2822-06 2835-15 2838-28 294843 306048 304749
SAC 2008 2409+06 2716+02 2824-03 2832-14 2736-27 294642 315648 294451
SAN 3112 2616+14 2324+11 2326+07 2435-07 2340-22 234939 235748 226753
SBA 0207 3318+10 3121+08 2824+04 2533-10 2638-24 244440 244350 244553
SFO 3021 3017+06 2922+02 3028-02 2833-13 2941-26 326140 328348 316254
SIY      2606+02 2315-04 2518-09 2829-16 2829-29 262244 283648 293947
WJF      2813+11 2820+09 2623+05 2339-10 2346-23 235140 235150 235854
AST 2310 2410-01 2511-06 2513-11 2329-20 1949-30 185644 204548 253145
IMB              2705-01 2509-05 2223-16 1438-27 162845 182950 193748
LKV              2517-02 2218-07 2226-17 1523-28 180845 261147 232246
OTH 2211 2311-01 2613-06 2722-08 2524-19 2622-29 272443 294046 294348
PDX 2610 2516-01 2512-04 2211-09 2323-18 1942-28 186145 204350 232545
RDM      2717+00 2411-03 2316-06 2229-16 1742-27 183746 202549 212346
GEG      2908+08 0206+02 1415-02 1756-14 1846-27 185344 185851 195651
SEA 2510 2411-01 2410-05 1913-09 2025-18 1953-28 187945 195751 213046
YKM 3019 2409+03 2114+00 1821-06 2139-17 1657-27 185745 194752 194248
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- ❏ How often is the Wind and Temperature Aloft Forecast (FB) issued, and when is it valid? The forecast is now produced 4 times per day (though the PHAK wrongly still says twice daily). The wind and temperature information depicted in the forecast are predicted to occur at the valid time specified in the header; however, the information **can** be used for flights occurring within the specified “for use” time window.

- ❏ Are the wind directions true or magnetic? True.

- ❏ What does 9900 mean? Winds are light and variable, less than 5 knots.

- ❏ Why are wind and temperature not listed for SIY at 3000 feet? Wind is not listed within 1,500 feet of a location’s elevation, as surface friction makes the wind predictions difficult. Temperatures are only provided for the 6,000 feet level and above. Use the METAR/TAF to interpolate winds and temperature at altitudes near field elevation.

- ❏ Why is no temperature listed for BIH at 6,000 feet? Temperatures are not listed within 2,500 feet of a location’s elevation (and again, never for the 3,000 feet elevation).

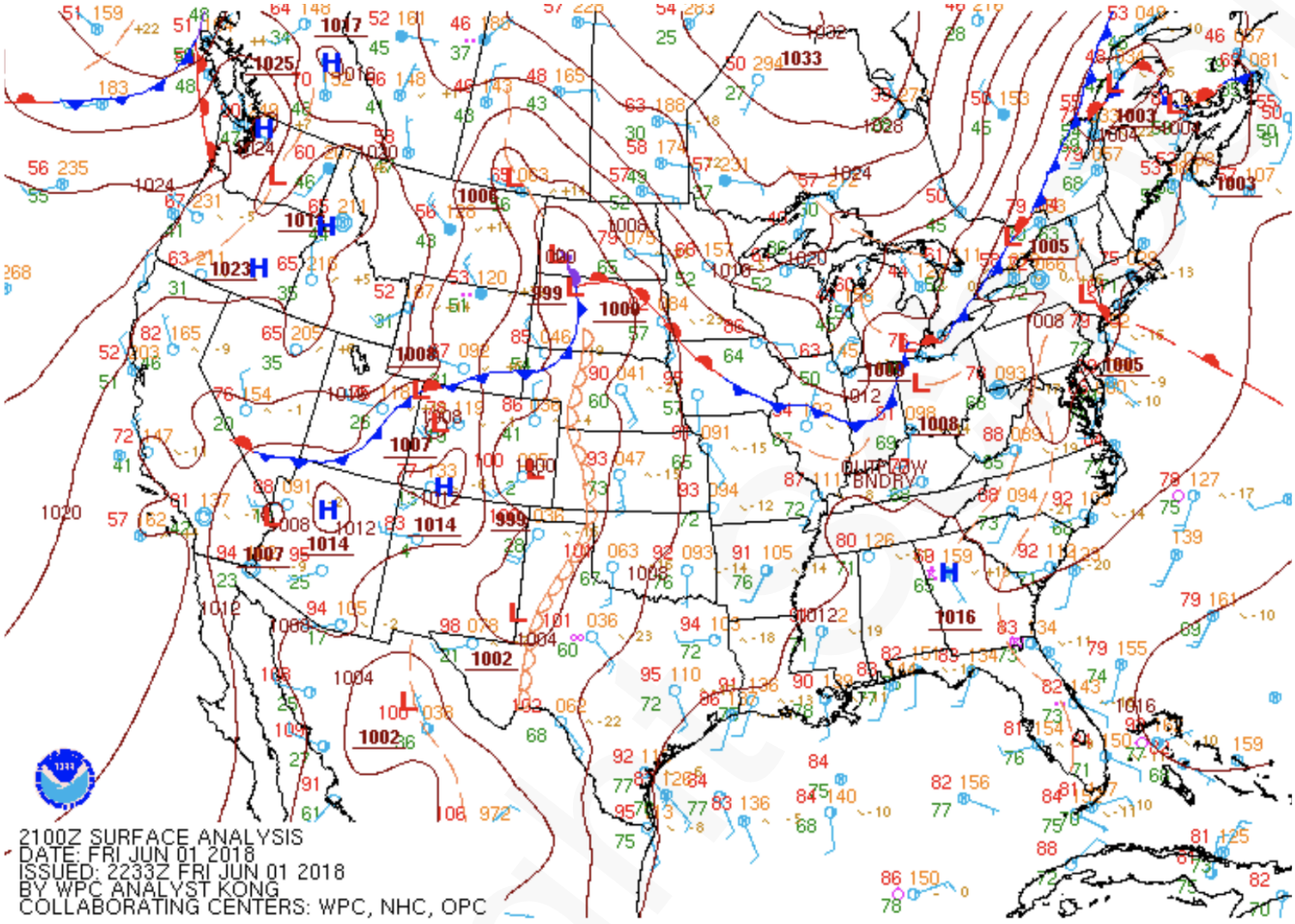
- ❏ What wind and temperature would you expect in the vicinity of the FOT station at 34,000 feet? Wind from 320 at 105 knots, temperature -47 degrees Celsius. Because the wind speed is over 99 knots, but only two digits are available for speed, the first digit of the direction is increased by 5; obviously, winds will never be from 820 degrees.

- ❏ At that altitude, what tells you that the temperature is negative? The header states that all temperatures above FL240 are negative.

- ❏ Would you expect stable or unstable air flying near SEA below 12,000 feet? Why? Stable. A temperature drop of less than 3 degrees for every 1,000 feet of increased altitude is generally indicative of stable air. In the case of SEA, the temperature drops only 8 degrees between 6,000 and 12,000 feet. Additionally, the change in wind direction and velocity with increasing altitude is small, lending additional evidence for stable air conditions.

- ❏ What is the freezing level along your route of flight? Find the winds aloft forecast for your region, then find/interpolate the altitude with a temperature of 0 degrees Celsius.

- ❏ Are the altitudes depicted on this forecast shown in MSL, AGL, or pressure altitudes? MSL below 18,000 feet; pressure altitudes (flight levels) starting at 18,000 feet and above.



- ❏ What are the issuance and valid times for the Surface Analysis Chart? This chart is issued every 3 hours, once analysis of the observed weather is complete. The valid times are either 00, 03, 06, 09, 12, 15, 18, or 21 UTC (hours divisible by 3). In the case of the chart above, the weather shown on the chart is valid for 2100Z.

- ❏ What type of chart is this? Analysis.

- ❏ What do the maroon solid lines represent? Isobars.These curves connect points of equal sea level pressure.

- ❏ If the number on the map reads “1014”, does that mean a pressure gauge at that location would read 1014 millibars? No; the number on the map shows station pressure *adjusted down to sea level.* This allows you to see atmospheric pressure patterns without the complicating factor of varying terrain elevation.

- ❏ What kind of weather would you expect to encounter in areas where the isobars are close together? Why? High winds. Isobars close together indicate a steep pressure gradient, and this causes the air to be more inclined to move.

- ❏ What does the orange scalloped line extending up from Mexico continuing through the middle of the U.S. represent? Describe this weather phenomenon. It represents a dry line. During parts of the year, moist air comes up from the Gulf of Mexico. The result is that moist air blankets the eastern U.S., whereas dry air remains dominant in the southwest. The dividing line is known as the dry line.

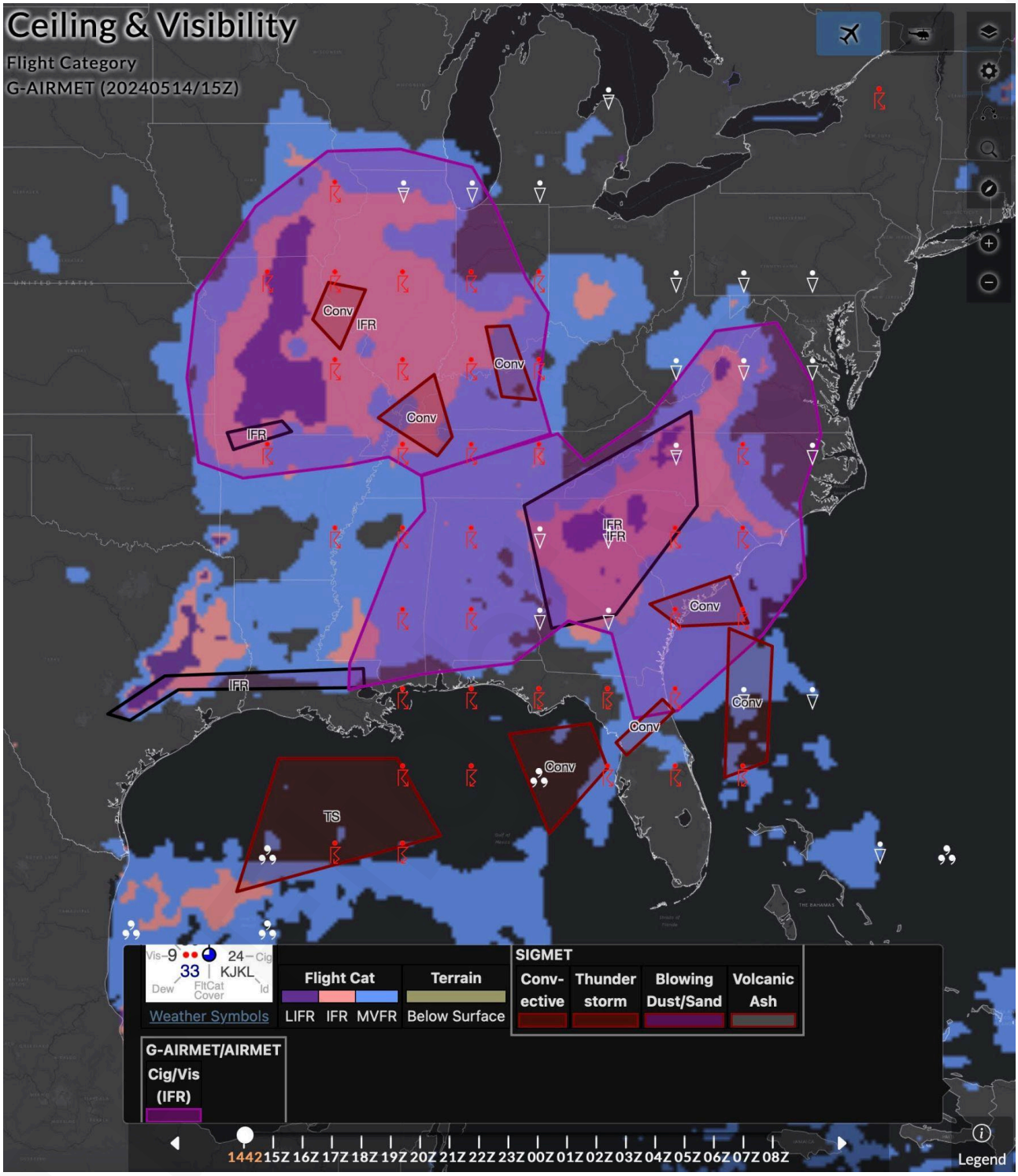
- ❏ What does the dashed orange line extending up from Florida along the east coast represent? What kind of weather would you expect to encounter flying along this line? It represents a trough, an elongated area of relatively low pressure. Expect generally poor weather, as low pressure systems involve updrafts which are conducive to convective activity.

- ❏ The station plot in south western California is a blue circle surrounded by another blue circle. What does this symbol indicate? Winds calm.

- ❏ Surrounding that symbol, what do the red “81,” green “42,” orange “137,” and orange “\” with a “-7” to the right of it, all represent? Temperature 81 degrees Fahrenheit, dewpoint 42 degrees Fahrenheit, pressure 1013.7 millibars, pressure continuously fell over the previous 3 hours by 0.7 millibars.

- ❏ What does an “M” inside a station plot circle indicate? The cloud observation is missing.

- ❏ In northern Georgia there is a pink “R” just to the left of the high pressure system. What does this symbol indicate? Thunderstorm.



- ❏ Looking at eastern Texas, what do the colors on this Ceiling and Visibility Chart (CVA) indicate? Blue: Marginal VFR. Pink: IFR. Purple: Low IFR.
  - ❏ Specifically, what type of weather qualifies as MVFR, IFR, and LIFR?

- MVFR: Ceilings 1,000 to 3,000 ft. and/or visibility 3-5 SM.
- IFR: Ceilings 500 to less than 1,000 feet and/or visibility 1 to less than 3 SM.
- LIFR: Ceilings less than 500 ft. and/or visibility less than 1 SM.

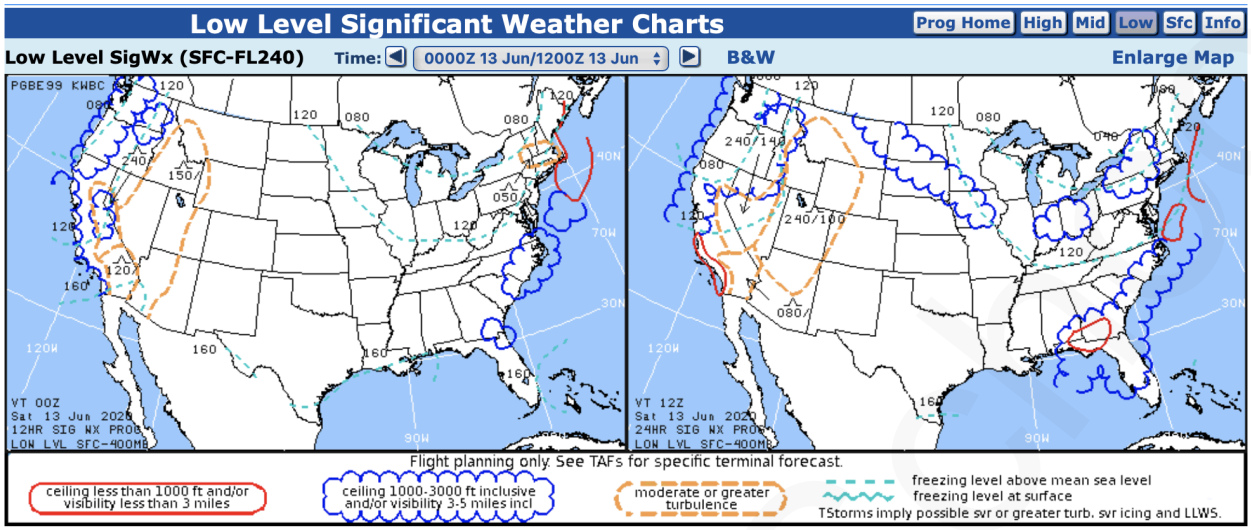
❏ Are MVFR conditions considered to be a sub-type of VFR weather conditions, or are they non-VFR conditions? Same question for LIFR - do LIFR conditions still fall within the category of IFR conditions? Yes, MVFR and LIFR still fall within the VFR and IFR weather categories, respectively (so weather less than 3 SM and/or 1,000 ft. ceiling is always considered IFR). “MVFR” and “LIFR” are simply nomenclature the FAA use on some charts to designate more intense subcategories of VFR or IFR weather conditions.

❏ Would it be wise to use this chart to determine cloud position along your route? Why or why not? No, this chart merely shows IFR/VFR conditions, not cloud position. If the visibility in Texas were ½ SM due to mist with no cloud ceiling, the region would be colored purple - same color as if the ceiling were 004OVC and the visibility were 20 SM. Also, ceilings beginning above 3,000 ft., as well as FEW and SCT clouds, are not depicted on this chart. Also, the chart does not specify cloud bottoms and tops.

❏ So what chart should be used to determine cloud location, along with their top and bottom altitudes? Select “Clouds” from the “Weather” tab on the GFA tool. Zoom in on your flight route area - the ceilings will populate.

❏ What are represented by the purple, red, and black borderlines surrounding various regions on the chart? Per the legend at the bottom of the image: Purple: AIRMET for IFR conditions. Red: SIGMETS (or CONVECTIVE SIGMETS if “Conv” is shown). Black: Center Weather Advisory (meaning either an update to an existing AIRMET or SIGMET, or an unscheduled advisory when there is not already an existing AIRMET or SIGMET).

❏ How often are Center Weather Advisories (CWAs) issued, and for how long are they valid? Issued as necessary for weather forecast to occur within 2 hours. Valid for 2 hours.



- ❏ What type of chart is a Low Level Significant Weather Prognostic Chart - forecast, observation, or analysis? Forecast.

- ❏ What kind of weather is depicted on this chart? Areas of IFR and MVFR, moderate or greater turbulence, and freezing levels.

- ❏ What are the issuance and valid times for this chart? It is issued 4 times a day, and valid at the specific times listed on the charts. The left and right panels will always be 12 hours apart.

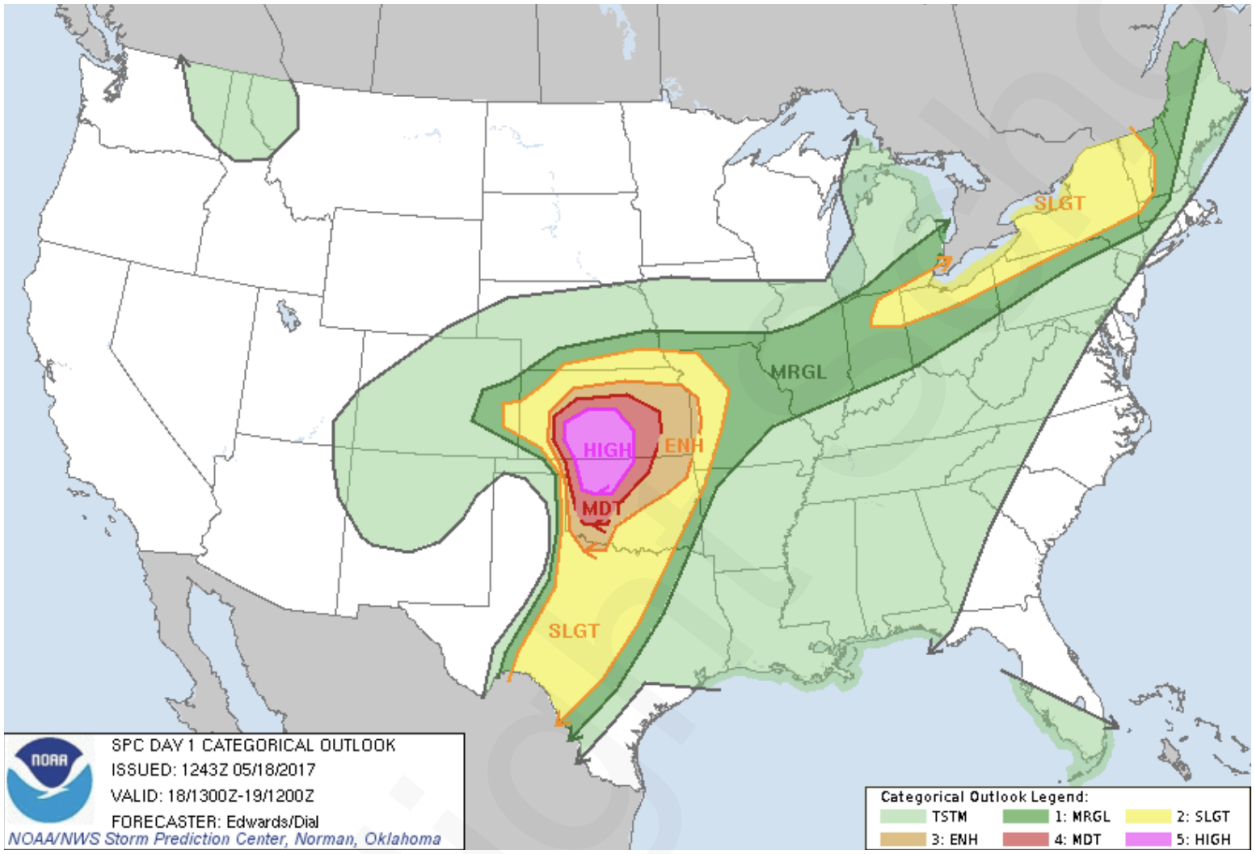
- ❏ On the left panel, what does the "/" after the "150" in Idaho mean? The symbol means *down to the surface*, so the moderate turbulence descends from 15,000 feet MSL down to the surface.

- ❏ Suppose you were planning a flight departing from a controlled airport in eastern North Carolina at 0000Z. That area is surrounded by a blue scalloped curve. If the forecast holds, will you be able to take off without being on an IFR flight plan? Yes, marginal VFR (as indicated by the blue scallops) is still at least 3 statute miles & 1,000 foot ceilings or greater, better than VFR departure minimums.

- ❏ What if you were departing from Los Angeles at 1200Z, in the area outlined in red? No, that indicates either visibility less than 3 miles or ceilings below 1,000 feet, so you must be on an IFR flight plan.

- ❏ You are flying from Nevada to Colorado. Do you think it would be better to get your freezing level from this chart or from the Winds Aloft? Winds Aloft, as it will indicate the precise freezing level for your location.

- ❏ The dashed orange line represents areas with “moderate or greater turbulence.” What symbol does this chart use to differentiate severe and extreme turbulence from moderate? It uses the same dashed orange line, except the listed altitude would be accompanied by more of the little turbulence symbols stacked up above it in order to indicate more intensity.



- ❏ What type of chart is a Convective Outlook? Forecast.

- ❏ What are its issuance and valid times? The Day 1 Outlook is issued 5 times a day, with the valid time frame specified on the chart. (Other Convective Outlooks show forecasts that extend up to 8 days, and those are issued less frequently.)

- ❏ What weather information does this chart provide? It shows 2 things: 1) the probability of *severe* convection (meaning tornados, wind gusts 50 knots or greater, or hail 1 inch in diameter or greater), and 2) *non-severe* (general) convection.
- ❏ What do the colors represent? The light green TSTM areas represent *non-severe* (general) convection. The rest of the colors indicate areas of marginal, slight, enhanced, moderate, and high probabilities of *severe* thunderstorms occurring.

<u>METAR</u>

- ❏ What type of weather product is a METAR? Observation.

- ❏ When is it issued, and what is its valid time? METARs are issued hourly, usually toward the end of the hour, and valid at the time of observation specified on the METAR.

- ❏ What does METAR stand for? Aviation Routine Weather Report (the acronym comes from the French translation of Aviation Routine Weather Report).

- ❏ What kind of weather product will be released in place of a METAR if there is a significant weather change prior to the next scheduled report? A Special Weather Report, abbreviated SPECI.

KSFO 121756Z 26020G27KT 200V290 R17L/2600FT RA FG VV002 FEW005 SCT015 SCT100 BKN200 18/12 A3009 RMK AO2 RAB46 PK WND 27029/1729 WS010/18040KT LTG DSNT S OCNL LTGICCC SE CB DSNT S TS SE MOV S SLP191 T01780117 $

- ❏ Does this METAR show VFR or IFR conditions at KSFO? Why? IFR, due to visibility (2,600 feet) being less than 3 SM, as well as the ceiling (200 feet) being less than 1,000 feet.

- ❏ What is the ceiling? 200 feet, due to the vertical visibility group.

- ❏ Are the reported winds true or magnetic? True.

- ❏ Is “BKN200” in MSL or AGL? Clouds on METARs (and TAFs) are always given in feet AGL.

- ❏ What is the gust factor? 7 knots (27 minus 20, the difference between sustained and gusting winds).

- ❏ What does “A02” indicate? Is this more or less advanced than an A01? The station is automated with a precipitation discriminator, and it is more advanced than A01.

- ❏ Is the wind reported here blowing westbound or eastbound? Eastbound; the wind is coming FROM 260 degrees.

- ❏ What kind of weather would you expect to accompany a small temperature/dewpoint spread? Visible moisture: clouds, possibly fog and mist.

- ❏ What do the following abbreviations taken from the METAR above mean?
  - 200V290: Wind direction is variable between 200 and 290 degrees.
  - R17L/2600 ft: Runway visual range for Runway 17L is 2,600 feet.

- VV002: Vertical visibility is 200 feet (ceiling is indefinite, so vertical visibility becomes the ceiling).
- RAB46: Rain began 46 minutes past the hour.
- PK WND 27029/1729: The peak wind was from 270 at 29 knots, occurring at 1729Z.
- WS010/18040KT: Wind shear: at 1,000 feet AGL, the wind shifts to 180 at 40 knots.
- LTG DSNT S OCNL LTGICCC SE CB DSNT S TS SE MOV S: Lightning distant south, occasional lightning in-cloud and cloud-to-cloud to the southeast, cumulonimbus clouds in the distant south, thunderstorm to the southeast moving south.
- SLP191: Sea level pressure is 1019.1 millibars.
- T01780117: More precise temperature and dewpoint data: temperature is 17.8 degrees Celsius, dewpoint is 11.7 degrees Celsius.
- $: Maintenance needed.

TAF

❏ What kind of weather product is a TAF? A forecast, as the name suggests.

❏ When is a TAF issued and what is its valid time? TAFs are issued 4 times a day (0000Z, 0600Z, 1200Z, and 1800Z), and are valid for either 24 hours or 30 hours, as depicted on the TAF.

❏ What does TAF stand for? Terminal Aerodrome Forecast.

❏ What is the range of a TAF? In other words, the TAF describes the weather extending how far out from the station? 5 statute miles from the center of the runway complex.

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KACV 121740Z 1218/1318 33010KT 4SM -SHRA BR SCT002 SCT016 OVC035
 TEMPO 1218/1219 BKN002 OVC016
 FM122200 33010KT 6SM -TSRA SCT015 BKN020
 TEMPO 1222/1302 SCT020 OVC050
 FM130600 35003KT P6SM -SHRA BKN015 OVC025
 FM131600 24009KT P6SM VCSH SCT025 OVC050 PROB30 1317/1318 3SM
 TSRA BKN030CB
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❏ What does TEMPO mean? It means that the indicated weather in that group is expected to last for less than 1 hour, and in total, less than half of the time window indicated.

❏ Are the conditions forecast to be VFR or IFR on the 12th at 19:30? VFR.

❏ At what time, or times, are conditions forecast to become IFR? Then when do they become VFR again? IFR conditions are forecast between 18:00 - 19:00 on the 12th. After 19:00 the weather returns to VFR.

- ❏ Decode: -TSRA, BR, and VCSH: Respectively: thunderstorm with light rain, mist, showers in the vicinity.

- ❏ Would you expect lower visibility if FG or BR were reported? FG. Fog is reported when visibility is less than 5/8 of a statute mile (or 1,000 meters); mist (BR) is used when it is above that mark.

- ❏ Decode "PROB030 1317/1318 3SM TSRA BKN030CB": There is a 30% probability that the weather between 17:00Z and 18:00Z on the 13th will drop to 3 SM visibility, due to thunderstorms with moderate rain, and broken cumulonimbus clouds at 3,000 ft AGL.

<u>AIRMET (WA), SIGMET (WS), Convective SIGMET (WST)</u>

- ❏ What are other weather product(s) that provide pilots with weather information beyond the 5 SM scope of a TAF? AIRMETs, SIGMETs, and Convective SIGMETs.

- ❏ What are the 4 types of inflight aviation weather advisories? SIGMET, Convective SIGMET, AIRMET, and Center Weather Advisory (CWA).

- ❏ What is a Severe Weather Watch Bulletin (WW)? WWs supplement those 4 inflight aviation weather advisories.

- ❏ How are inflight aviation weather advisories disseminated? They are issued by the Aviation Weather Center (AWC) and are periodically announced by ATC to pilots in flight. Pilots can also get these while enroute from an FSS. They are obtainable on the ground through virtually all approved aviation weather sources.

- ❏ Are these products intended for preflight planning, enroute weather advisories, or both? Both.

- ❏ Are altitudes in these products MSL or AGL? MSL, unless stated otherwise.

- ❏ Are AIRMETs intended for pilots of small, large, or all aircraft? All, although they're certainly more pertinent for smaller aircraft and pilots without instrument ratings. Put differently, an AIRMET details significant enroute weather phenomena that could be of interest to all aircraft, but are potentially hazardous to small aircraft.

- ❏ What is an AIRMET, and how is it different from a SIGMET? An AIRMET is a forecast that describes significant weather occurring at intensities lower than weather requiring the issuance of a SIGMET. Generally, an AIRMET is issued for *moderate* weather, whereas a SIGMET is issued for *severe or greater* weather.

- ❏ What does AIRMET stand for? Airmen's Meteorological Information.

- ❏ Define “moderate turbulence.” Changes in altitude and/or attitude occur, but the aircraft remains in positive control at all times. Usually variations in indicated airspeed will occur. Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.

- ❏ What are the issuance and valid times for AIRMETs? They are issued every 6 hours, and valid for 6 hours. Each can also have an outlook describing weather over the following 6 hours, if conditions will continue. Unscheduled amendments and updates are issued as required.

- ❏ What are the three types of AIRMETs, and what type of weather is included in each? The three types are:
  - Tango: moderate turbulence, sustained surface wind greater than 30 knots, and/or non-convective low-level windshear potential below 2,000 feet AGL.
  - Sierra: extensive IFR conditions (less than 3 SM visibility or less than 1,000 foot ceilings) and/or mountain obscuration.
  - Zulu: moderate icing, along with freezing level heights.

  For each of the three types, an AIRMET is issued if the conditions are occurring or are expected to occur over an area of at least 3,000 square miles (for comparison, a square 55 miles on each side would meet that 3,000 square mile criterion).

- ❏ Would the existence of an AIRMET Tango enroute for moderate turbulence affect your go/no-go decision? In what way? Possibly, although probably not in isolation. Moderate turbulence alone is not generally dangerous to the aircraft, but could be uncomfortable, particularly if it continues for an extended period. Passengers who are not used to light aircraft ride quality may find it objectionable. Also, it may coincide with windy conditions at the surface that could make takeoff and landing challenging. Investigate further to see if the turbulence and other conditions exceed your personal minimums, and plan around the affected area if feasible. Look for PIREPs, but be sure to note what kind of aircraft has reported the turbulence (heavy jets are less affected). Have a plan to get back on the ground if the actual conditions aloft are worse than you’re comfortable flying in.

- ❏ Are SIGMETs intended for pilots of small, large, or all aircraft? All aircraft, but unlike with AIRMETs, SIGMETs indicate weather that is potentially hazardous to all aircraft.

- ❏ What does SIGMET stand for? Significant Meteorological Information.
- ❏ What are the issuance and valid times for SIGMETs? Issued as necessary, valid for up to 4 hours, except that SIGMETs involving tropical cyclones and volcanic ash are valid for 6 hours. Updates and corrections issued as necessary.

- ❏ What type of weather is included in a SIGMET? SIGMETS are issued when the following *non-convective* weather phenomena occur or are expected to occur over an area of at least 3,000 square miles:
  - Severe or extreme turbulence or clear air turbulence not associated with thunderstorms.
  - Severe icing not associated with thunderstorms.
  - Widespread dust storm or sandstorm lowering surface visibilities to below 3 miles.
  - Volcanic ash.

- ❏ Define “severe turbulence.” Severe turbulence causes large, abrupt changes in altitude and/or attitude usually accompanied by large variations in indicated airspeed. The aircraft may be momentarily out of control.

- ❏ How would the existence of a SIGMET along your flight path affect your go/no-go decision? You might be able to choose a different routing that avoids the SIGMET area. However, if this is not possible, make a no-go decision.

- ❏ What is a Convective SIGMET, and how is it different from a SIGMET? The key word/differentiator is “convective.” Unlike SIGMETs, Convective SIGMETs alert pilots to more extreme weather *associated with thunderstorms*. To quote the AIM directly: “A Convective SIGMET may be issued for any convective situation that the forecaster feels is hazardous to all categories of aircraft”.

- ❏ What are the issuance and valid times for a Convective SIGMET? Issued hourly at 55 minutes past the hour, then updated as required. Valid for up to 2 hours.

- ❏ What type of weather is included in a Convective SIGMET?
  - Severe thunderstorms that produce:
    - Surface winds greater than or equal to 50 knots.
    - Hail at the surface greater than or equal to ¾ inches in diameter.
    - Tornadoes.
  - Embedded thunderstorms.
  - A line of thunderstorms.
  - Thunderstorms producing precipitation greater than or equal to heavy precipitation affecting 40 percent or more of an area of at least 3,000 square miles.

- ❏ If a Convective SIGMET does not mention turbulence, icing, or wind shear, does that mean you can expect smooth air and no icing? No, any Convective SIGMET implies severe or greater turbulence, severe icing, and low-level wind shear.
- ❏ What is a Center Weather Advisory (CWA)? This is an unscheduled inflight weather advisory issued for hazardous weather when there is either no existing advisory (i.e., an AIRMET/SIGMET/Convective SIGMET), or to supplement an existing advisory. The FAA describes a CWA as a “nowcast” for conditions developing in the next 2 hours.

- ❏ For how long are CWAs valid? Up to 2 hours.

Graphical Area Forecast (GFA)

- ❏ What is the GFA tool, and what is it used for? The GFA provides aviation weather information to give users a complete visual picture of the weather that may impact their flights. Users can select for virtually any type of weather, time, altitude, and flight path.

- ❏ How often is GFA information updated, and what are its valid times? GFA information is updated continuously, valid for the selected times. Users can select FORECAST for a range of valid times that extend 15 hours into the future, or select OBSERVATION for valid times in the previous 14 hours.

PIREP

- ❏ Interpret this PIREP: **KCMH UA /OV APE 230010/TM 1516/FL085/TP BE20/SK BKN065/WX FV03SM HZ FU/TA 20/TB LGT/IC MDT MXD 040-050/RM LLWS –15 KT SFC-030 DURGC RY 22 CMH** Nearest station: KCMH; message type: routine (non-urgent) report. / Location: weather occurred 10 nautical miles from the APE VORTAC on the 230 radial. / Time: reported weather occurred at 15:16Z. / Altitude: the weather was encountered at 8,500 feet MSL. / Aircraft type: type of aircraft reporting the weather was a BE20. / Sky condition: broken at 6,500 feet MSL. / Flight visibility and weather: 3 SM due to haze and smoke. / Air temperature: 20 degrees. / Turbulence: light. / Icing: moderate mixed icing between 4,000 and 5,000 feet MSL. / Remarks: low-level wind shear, pilot reported minus (a loss of) 15 knots between the surface and 3,000 feet during climb out from runway 22 at CMH airport.

- ❏ Who do you contact to file a PIREP? ATC or FSS.

- ❏ What does “UUA” (instead of UA) signify on a PIREP? An urgent PIREP. These are ones reporting tornadoes, funnel clouds or waterspouts; severe or extreme turbulence; severe icing; hail; volcanic ash; low-level wind shear; or any other condition the controller considers to be hazardous to flight operations.

- ❏ What are some ways to check for PIREPs on the ground as part of your preflight planning? How about in-flight? On the ground you can use ForeFlight, aviationweather.gov, 1800wxbrief.com, or call a briefer. In the air, you can request PIREPs from ATC or an FSS.
- ❏ What is the procedure for filing a PIREP? PIREPs can be filed in-flight with either ATC or FSS. The AIM advises against being overly concerned with strict format or phraseology: “The important thing is that the information is relayed so that other pilots may benefit from your observation.” Pilots should simply give position, time, altitude, type of aircraft, and a description of the weather” (sky cover, flight visibility, precipitation, restrictions to visibility, temperature, wind direction and strength, turbulence, icing, additional remarks).

❏ Are altitudes in a PIREP reported in feet MSL or AGL? MSL, unless noted otherwise.

FSS Weather Briefings

❏ Describe the 3 types of weather briefings pilots can request from an FSS briefer. When should each be used?
- Standard briefing: this briefing provides a complete picture of the weather and is the most detailed of all briefings. It includes adverse conditions, VFR flight not recommended (if applicable), a synopsis, current conditions, en route forecast, destination forecast, winds and temperature aloft, NOTAMs, prohibited areas and SFRAs, ATC delays, and other information specifically requested by the pilot. This type of briefing should be obtained prior to the departure of any flight.
- Abbreviated briefing: this is a shortened version of the standard briefing that should be requested when a departure has been delayed or when specific weather information is needed to update a previous standard briefing.
- Outlook briefing: this briefing should be requested when a planned departure is 6 or more hours away. It provides initial forecast information that is limited in scope, but that can influence decisions regarding route of flight, altitude, and ultimately the go/no-go decision. A follow-up standard briefing prior to departure is advisable.

Atmospheric Composition and Stability

❏ Describe the composition of the Earth's atmosphere. It consists of 78% nitrogen, 21% oxygen, and 1% other gases (argon, carbon dioxide, and other minor components).

❏ What is the atmosphere? It is a layer of gas (along with some suspended liquids and solids) surrounding the Earth, held in place by Earth's gravity. It extends from the surface and gradually becomes thinner with altitude; about half of it by mass is within 18,000 feet of Earth's surface, and about 90% is within 53,000 feet of the surface.

❏ The Earth's atmosphere is divided into 5 concentric layers. In what layer do we fly, and up to what altitude does it extend? Piston trainers like the CE-172 and PA-28 fly in the troposphere, which extends up to approximately 36,000 feet (at a boundary called the tropopause). This layer is where most of Earth's weather occurs. Many jets can fly above this, in the stratosphere.

❏ In the standard atmosphere, how do temperature and pressure change with altitude? For every 1,000 feet of altitude gained, the temperature decreases by 2 degrees C, and the pressure decreases by 1 inch Hg.

❏ What does it mean to say that an atmosphere is "stable"? "Stability" refers to the atmosphere's ability to resist vertical movement of the air. For example, if a parcel of air

gets pushed upward in a *stable* atmosphere, it will quickly cease rising or even get pushed back down; whereas a parcel of air pushed upward in an *unstable* atmosphere will continue rising.

- ❏ What kind of weather would you expect to form in an *unstable* atmosphere? Turbulent airflow, clouds with extensive vertical development, and convective activity in general.

- ❏ What two things determine the stability of the air? Temperature and moisture.

- ❏ If the air is cool and dry, would this be indicative of a stable or unstable atmosphere? How about warm and wet air? Why? Cool dry air tends to be stable, while warm wet air tends to be unstable. Warm air is more inclined to rise, and air that is wet has more water vapor (which is lighter than oxygen and nitrogen), so it's less dense and even *more* inclined to rise.

- ❏ What does "adiabatic lapse rate" refer to? How does it relate to stability? As a parcel of air rises into an area of lower pressure, it expands to take up more space. This means that it does work on its surroundings, by pushing the surrounding air aside. Work is a form of energy transfer, so the expanding parcel of air transfers some of its energy into the surrounding air. As it loses energy, the parcel of air cools down. (Eventually, heat energy will transfer back into the parcel of air, but this is a much slower process. In the short term we can assume no transfer of heat, which is what "adiabatic" literally means.) Dry air decreases in temperature by about 3 °C per 1,000 feet of pressure drop as it rises (the "*dry* adiabatic lapse rate"). But once the air becomes saturated with water vapor, any further cooling causes the vapor to condense and form cloud, which releases energy. Because of this, moist/saturated air cools at a slower rate, in the range of 1.1 - 2.8 °C per 1,000 feet (the "*moist* adiabatic lapse rate"). If the adiabatic lapse rate is higher than the *environmental* lapse rate (the actual rate of change in temperature with altitude in the atmosphere, which *on average* is 2 °C per 1,000' but varies widely), then a rising parcel becomes cooler than its surroundings and sinks—a stable atmosphere. Conversely, if the adiabatic lapse rate is lower than the environmental lapse rate, a rising parcel stays warmer than its surroundings and keeps rising—an unstable atmosphere.

<u>Wind (e.g. crosswind, windshear, mountain wave, etc.)</u>

- ❏ What causes wind to form? Uneven heating of the Earth's surface causes density and pressure changes in the atmosphere - air then flows from high to low pressure. Additionally, the Coriolis force contributes to air movement.

- ❏ What's the difference between "wind" and "convective currents"? The former moves horizontally - the latter moves up and down.

- ❏ Why can it be dangerous to take off with a tailwind? Because a higher ground speed is required, meaning more stress on the tires and gear while on the ground, a longer takeoff roll, and a more shallow climb angle.

- ❏ You're flying from California to Florida. There is a high pressure system along your route. Would you get more favorable winds flying along the north or south side of the high pressure system, and why? North - wind flows clockwise around a high pressure system.

- ❏ Flying over pavement on short final, would you expect updrafts or downdrafts? Updrafts.

    - ❏ How about over water or areas of vegetation like a group of trees? Downdrafts.

- ❏ Describe how land breezes and sea breezes form. During the day, land heats faster than water, so the air over the land becomes warmer and less dense. It rises and is replaced by cooler, denser air flowing in from over the water. This causes an onshore wind called a sea breeze. Conversely, at night land cools faster than water, as does the corresponding air. In this case, the relatively warmer air over the water rises and is replaced by the cooler, denser air from the land, creating an offshore wind called a land breeze.

- ❏ What are mountain waves? They are turbulent waves that form when stable air flows over a mountain or mountain ridge.

    - ❏ Where do they form? They form above and downwind of mountains, extending up to 600 miles downwind from the mountain range, and up to (and even above) the top of the troposphere.

    - ❏ What type of cloud indicates the presence of mountain waves? Lenticular.

    - ❏ In windy conditions, would you expect more favorable conditions approaching a mountain from the windward or leeward side? Why? Windward. As the air flows down the *leeward* side of the mountain, the air follows the contour of the terrain and is increasingly turbulent. This tends to push an aircraft into the side of the mountain. The stronger the wind, the greater the downward pressure and turbulence become. Downdrafts can be severe.

    - ❏ What technique should pilots use if flying low-level over a mountain range? Cross the range at an angle, making it easier to turn around if necessary.

<u>Moisture/Temperature</u>

- ❏ Does hot air hold more or less moisture than cold air? More.

- ❏ Define “dew point.” Then put it in layman’s terms. Dew point is the temperature to which the air must be cooled to become fully saturated. In layman’s terms, this means that the dew point is the temperature at which the air can hold no more moisture/water vapor - if the temperature drops further, then the water vapor becomes a visible liquid, i.e., it condenses.
    - ❏ What does a high dew point indicate? This indicates that there is more moisture in the air.
    - ❏ Explain relative humidity. Relative humidity is the amount of moisture in the air compared to the total amount of moisture the air could hold at that temperature. So a relative humidity of 65 percent means that the air is holding 65 percent of the total amount of moisture that it is capable of holding.
    - ❏ What would feel muggier, an atmosphere with a temperature of 80 degrees F and a dew point of 70 degrees F; or a temperature of 50 degrees F and a dew point of 50 degrees F (so 100% relative humidity)? The former - the dew point is higher, meaning there’d be more moisture in the air.
- ❏ What effect does the formation of water vapor (evaporation) have on the temperature? A cooling effect.
- ❏ Define the following:
    - ❏ Evaporation: liquid to gas/vapor. (E.g. sweat evaporating, or a lake drying up.)
    - ❏ Sublimation: solid to gas/vapor. (E.g. dry ice.)
    - ❏ Condensation: gas/vapor to liquid. (E.g. cloud/dew formation.)
    - ❏ Deposition: gas/vapor to solid. (E.g. frost.)

<u>Precipitation</u>

- ❏ What dangers can precipitation pose to pilots? It can reduce visibility, create icing situations through freezing rain or runway icing, negatively affect landing and takeoff performance, and contaminate fuel tanks and engines.
- ❏ How does precipitation form? It forms when water or ice particles in clouds grow (through collision and coalescence) to a sufficient size such that the atmosphere can no longer support them.
- ❏ What three ingredients are necessary for the formation of precipitation? Water vapor, sufficient lift to condense the water vapor into clouds, and a growth process that allows cloud droplets to grow large and heavy enough to fall as precipitation.
- ❏ What are the various types of precipitation? Rain, drizzle, snow, ice pellets/crystals, hail.

- ❏ What do ice pellets and freezing rain indicate in terms of the temperature makeup of the atmosphere? They indicate a temperature inversion above. The formation of both types of precipitation requires the precipitation to pass through a cold/freezing temperature layer, then a warm/above-freezing layer, then back through a cold layer where the precipitation either refreezes as ice pellets, or becomes supercooled/freezing rain.

- ❏ What is virga? Precipitation that evaporates before hitting the ground.

<u>Weather System Formation Including Air Masses and Fronts</u>

- ❏ What is a front, and how does one form? A front is the boundary layer between two types of air masses. An air mass is a large body of air that takes on the characteristics of the surrounding area or source region, generally classified as tropical or polar. As an air mass moves across a body of water or land, it eventually comes in contact with another air mass, resulting in the formation of a front.

- ❏ When does a cold front occur? When a mass of cold, dense, and stable air advances and replaces a body of warmer air.

    - ❏ Describe the typical dimensions/shape and speed of a cold front? Cold fronts move rapidly, progressing at a rate of 25-30 mph. They are shaped like a snow plow, sliding under the warmer, less dense air ahead of it and forcing it aloft.

    - ❏ What is a sign of imminent cold front passage? A high dew point and a falling barometric pressure.

    - ❏ What kind of weather would you expect to accompany a passing cold front? The weather changes suddenly as the steep slope of the fast-moving cold front hits, often with little or no warning; towering cumulus or cumulonimbus clouds dominate the sky, accompanied by heavy showery precipitation, unstable air, lightning, thunder, hail, poor visibility, winds variable and gusty, temperature and dew point drop rapidly, pressure bottoms out then begins a gradual increase. After passage the weather clears rapidly. Good visibility and drier air prevails, along with colder temperatures and rising pressure.

- ❏ When does a warm front occur? When a warm mass of air advances and replaces a body of colder air.

    - ❏ What kind of weather would you expect to accompany a passing warm front? The front gives plenty of warning, then passes slowly, causing the weather to change gradually: warm, humid air gradually slides over the top of a relatively colder air mass, pushing the cold air away, leading to warmer temperatures, low ceilings and low visibilities with fog, stratiform clouds, steady continuous precipitation, drizzle, sleet, rain, and snow. When the warm front's air is unstable (common in the summer), thunderstorms and convection

can occur. Warm fronts take days to pass through a region, so the steady precip and low visibility and stratiform clouds tend to linger after the front passes.

- ❏ What is a stationary front? A stationary front occurs when the forces of two air masses are relatively equal, and the boundary (or front) that separates them remains stationary and influences the local weather for days.
    - ❏ What kind of weather would you expect to accompany a stationary front? A mixture of weather found in warm and cold fronts.
- ❏ What is an occluded front? This is when a fast-moving cold front catches up to a slow-moving warm front, forcing the warm air aloft.
    - ❏ What kind of weather would you expect to accompany the passage of an occluded front? A mixture of weather found in warm and cold fronts: usually as the occluded front approaches, expect warm front weather; this is immediately followed by cold front weather.
    - ❏ Describe a warm vs cold front occlusion. A cold front occlusion occurs when the fast moving cold front is colder than the air ahead of the slow moving warm front. A warm front occlusion occurs when the cold front's air is warmer than the air ahead of the warm front.
    - ❏ Which generally produces worse weather, a warm or cold occluded front? The weather is more likely to be severe and convective during a warm front occlusion provided that the warm air being forced aloft is unstable.
- ❏ What kind of weather is generally associated with a low pressure system? Inclement.
    - ❏ What direction does the wind flow around a low pressure system? Counter clockwise, inward, and upward.
- ❏ What kind of weather is associated with a high pressure system? Generally more favorable conditions, with light winds.
    - ❏ Describe the airflow around a high pressure system. Clockwise, outward, and downward.

<u>Clouds</u>

- ❏ What qualifies as a *ceiling*? FAA's definition (so this applies to us): the lowest cloud layer or obscuring phenomena reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial." ICAO's definition (different language, but in practice, virtually the same

meaning): the height above the ground or water of the base of the lowest layer of cloud covering more than half the sky.

- ❏ What causes clouds to form? The water vapor in rising air currents cools to its dew point and condenses onto miniscule particles of matter (like dust/salt/smoke) into visible moisture.

- ❏ Clouds are classified using the following nomenclature - describe each:

  - Cumulus: look like fluffy cotton balls - heaped or piled clouds. Bases are usually low-middle clouds, but tops can extend up to 60,000 ft.
  - Stratus: layered clouds, usually low-level.
  - Cirrus: thin, wispy, high-level clouds usually composed of ice crystals.
  - Castellanus: cloud with a common base but with separate vertical development, castle-like.
  - Lenticular: lens-shaped cloud that forms over mountains in strong winds.
  - Nimbus: rain-bearing clouds.
  - Fracto: ragged or broken clouds.
  - Alto: middle level clouds existing between 5,000 to 20,000 ft.

- ❏ What is the most dangerous cloud type to pilots? Cumulonimbus.

- ❏ What are the approximate altitude cutoffs that define *low*, *middle*, and *high* clouds? Low: surface - 6,500 AGL; middle - 6,500 AGL - 20,000 AGL; high - above 20,000 AGL.

- ❏ What would you do if approaching a cloud shaped like a lens (or like a flying saucer) positioned directly above some mountains. Why? Avoid it by a wide margin. Lenticular clouds form from mountain waves - they indicate excessive turbulence/winds.

<u>Turbulence</u>

- ❏ What are the 3 causes (or types) of turbulence? Describe each.

  - ❏ Convective: uneven heating of the Earth's surface on summer afternoons with little wind causes bubbles of warm air to rise, leading to rising and sinking air currents. Billowy cumuliform clouds on sunny afternoons are an indication of such turbulence.

  - ❏ Mechanical: caused by obstructions that disrupt smooth wind flow, instead creating eddies that get carried downstream. Mountain waves are one form of mechanical turbulence, as is turbulent air around airports caused by the wind flow colliding with hangars and buildings and other obstructions.

- ❏ Wind shear: this turbulence is generated between two wind currents of different direction and/or speeds. Temperature inversion boundary layers and Clear Air Turbulence (usually occurring between the jet stream and surrounding air) are two forms of this.

❏ What are the 4 levels of turbulence intensity, and what defines each?

- ❏ Light: causes slight changes in altitude and/or attitude. Occupants may feel slight strain against their seat belts. Unsecured objects may be displaced.
- ❏ Moderate: causes changes in altitude and/or attitude and indicated airspeed, but positive control is maintained. Occupants feel definite strains against seat belts. Unsecured objects are dislodged.
- ❏ Severe: causes large changes in altitude/attitude and large variations in indicated airspeed. Aircraft may be momentarily out of control. Occupants are forced violently against their seat belts.
- ❏ Extreme: causes aircraft to be violently tossed about, rendering it practically impossible to control. May cause structural damage.

❏ In windy conditions, why should pilots be on high alert for turbulence when overflying mountains? Due to mountain waves.

- ❏ What causes these? Wind flowing perpendicular to the mountains gets pushed aloft causing up/downdrafts and waves.

❏ At what altitudes is clear air turbulence (CAT) a very serious operational factor to flight operations?" All. Especially above 15,000 MSL, though.

- ❏ What is the best way to determine the location of CAT before a flight? PIREPs.

❏ Would you expect to encounter less turbulence flying through a small thunderstorm than through a large one? No, there's no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them.

<u>Thunderstorms/Microbursts</u>

❏ What ingredients are necessary for a thunderstorm to form? Sufficient water vapor, an unstable lapse rate, and an initial lifting action.

- ❏ Are all three always required? Yes.

- ❏ In terms of thunderstorm formation, must the moisture in the air be visible? No, water vapor is sufficient.

- ❏ What charts can you use to determine the presence of each ingredient? Plenty of options here. One viable answer: for moisture look at the dewpoint - a higher dew point means more water vapor; for instability look at the temperature lapse rate on the winds aloft chart; for a lifting action look at the surface analysis and/or prog chart for low pressure systems, frontal activity, etc.

- ❏ What is “unstable” air? Air that, when pushed upward, continues rising. Conversely, stable air resists upward movement.

- ❏ What are some examples of weather phenomena that can cause a lifting action? Orographic effects (wind moving upward across mountains and valleys), frictional effects (low pressure systems), frontal lifting, buoyancy (uneven heating of surface), converging winds around surface lows and troughs, drylines, outflow boundaries generated by prior storms, and local winds, such as sea breeze, lake breeze, land breeze, and valley breeze circulations.

- ❏ Explain each stage of a thunderstorm.

    - Cumulus: strong updrafts push warm, moist air upward until all the moisture becomes too heavy for the clouds to support.
    - Mature: the moisture, too heavy now for the updrafts and clouds to support, falls in the form of precipitation. When the precipitation reaches the surface, the mature stage begins. Precipitation descends through the cloud and drags the adjacent air downward, creating strong, cool downdrafts alongside the warm updrafts.
    - Dissipating: characterized mostly by downdrafts, which replace the updrafts, effectively cutting off the supply of moisture provided by the updraft. Precipitation tapers off and ends.

- ❏ What are the three principle thunderstorm types? Explain each.

    - Single-cell (aka air mass): like it sounds, a one-cell thunderstorm. Usually lasts 30 minutes. Easily circumnavigated by pilots. These are rare.
    - Multi-cell (aka steady-state): a multicell thunderstorm consists of a cluster of cells at various stages of their life cycles. With an organized multicell cluster, as the first cell matures, it is carried downwind, and a new cell forms upwind to take its place. A multicell cluster may have a lifetime of several hours (or more). New cells will continue to form as long as the three necessary ingredients exist.
    - Super-cell: this is an especially dangerous convective storm cell that consists primarily of a single, quasi-steady updraft that persists for an extended period of time. Updraft speeds may reach 9,000 feet per minute. Nearly all supercells produce severe weather

(large hail, damaging wind), and about 25 percent produce a tornado. These persist for many hours, and can be part of multicell storms as well.

- ❏ Generally, what causes air mass vs steady-state thunderstorms to form? The former usually form on hot afternoons due to surface heating, whereas the latter are associated with weather systems, like fronts or converging winds or troughs.

- ❏ What is it called when thunderstorms form in a line, continually re-forming at the leading edge of the system, extending laterally for hundreds of miles? Squall line.

- ❏ During what stage do weather hazards generally reach peak intensity? End of the mature stage.

- ❏ What marks the end of the mature stage? Anvil cloud top.

- ❏ How long is the typical life cycle of a single thunderstorm cell? Around 30 minutes.

- ❏ What clouds produce thunderstorms? Cumulonimbus.

- ❏ Should you *always* expect thunder and lightning in a thunderstorm? Yes, always.

    - ❏ What other kinds of weather would you expect? Every type of extreme weather, to include strong winds and turbulence, icing (including freezing rain), hail, heavy rain, and sometimes tornadoes.

- ❏ You're flying at night and find that you've flown into a thunderstorm. What procedures do the AIM recommend pilots follow here? Verify pitot-heat and defroster are on; set a power setting (and generally don't adjust it, unless necessary) to maintain an airspeed below Va; keep your eyes on your instruments, not outside; maintain a constant attitude while allowing the altitude and airspeed to fluctuate; don't turn back once you are in the thunderstorm as turning maneuvers increase stress on the aircraft; turn up cockpit lights to their highest intensity to lessen temporary blindness from lightning; disengage auto-pilot, if equipped.

    - ❏ Why is it important to disengage the auto-pilot, if equipped? The autopilot will mask the effects of icing/an impending stall. The autopilot will also try to maintain altitude, heading, and airspeed, despite the fact that proper technique for flying in a thunderstorm involves simply maintaining a pitch attitude and riding the waves, so to speak.

    - ❏ If you accidentally fly into a thunderstorm what airspeed will you fly? Little below maneuvering speed.

- ❏ If you're stuck in a thunderstorm would you try to maintain a level altitude or level attitude? Attitude. Doing otherwise could overstress the aircraft.

❏ By how many miles are you supposed to circumvent a thunderstorm? Why? 20 miles, to avoid hail and strong winds.

❏ Up ahead along your victor airway you see a thunderstorm - it appears to be moving to the right. The area to the left of the airway is clear. What are you going to do/say to ATC? "Center, Cessna ____, request to deviate approximately _____ degrees left of course for weather avoidance."

❏ What does the METAR symbol 'TSRA' mean? It means LIGHT RAIN associated with a thunderstorm.

❏ Is flying *under* a thunderstorm safe? No.

❏ As you turn final at your destination airport, you notice virga just above the runway. Your indicated airspeed starts increasing despite that fact that you're not adding power or increasing your descent rate. What do you think is going on here? You're approaching a microburst.

- ❏ Is this a dry or a wet microburst? Dry.
- ❏ What additional sign might you see at the surface of a dry-type microburst? A blowing ring of dust.
- ❏ What are you going to do? Add full power and start climbing - go around. If you're already in the microburst climb straight ahead; if you're approaching the microburst but not yet in it, immediately turn around while climbing.
- ❏ How strong can the downdrafts get? 6000 ft/min.
  - ❏ How strong can the horizontal winds get? 45 kt (90 kt shear).
- ❏ How long would you expect this microburst to last? 15 minutes maximum.
- ❏ What sort of weather activity needs to exist for a microburst to form? Convective.

<u>Icing and Freezing Level Information</u>

❏ Pretend the weather at your destination airport at your ETA is this: *071653Z 03004KT 10SM OVC040 07/02 A3029 RMK AO2 SLP260 T00670017.* You intend to file IFR and this airport has multiple approaches. Would you make a go or no-go decision? Why or why not?

No-go due to icing. With a normal lapse rate the temp at 4000 ft would be -1 degrees, and the ceiling is overcast at that altitude.

- ❏ Describe which charts and weather information you used to determine that we won't be at risk of flying into icing conditions. This will involve using the charts to both show where the clouds/visible moisture will be during every phase of the flight, as well as determining the freezing level throughout the route. There are many ways to effectively do this. Some options: Because the TAF range extends only 5 SM from the airport, and seeing as only larger airports have TAFs, determining cloud coverage beyond the range of these airports involves using the Graphical Area Forecast (GFA). The GFA tool on aviationweather.gov allows you to plot your flight path and show the cloud coverage along the entire route at various selected times. Determining precise freezing levels along your route involves using the winds aloft chart - be sure to use the stations along the entire route, not just departure and destination airport stations. More options include using graphical icing forecasts, PIREPs, freezing level charts, etc. Using the "show flight path" feature is always extremely helpful, as it allows you to see the location of this weather relative to your exact route.

- ❏ What kind of weather conditions need to exist for structural icing to form? Temperatures around freezing (close enough for the surface of the plane to be at or below 0 degrees C) and visible moisture.

    - ❏ Must this moisture be visible? Yes.

- ❏ What are the different types of icing and what characterizes each?

    - Clear (or glazed): transparent, smooth ice that forms when the temperature is just below freezing, allowing supercooled drops (either rain or cloud droplets) to spread out along the surface before slowly freezing. Clear ice is denser, harder, heavier, and more transparent than rime ice, and can form ice horns protruding from the leading edge surfaces.
    - Rime: rough, milky, opaque, beady ice formed by the rapid freezing of supercooled drops after they strike the aircraft. Due to the lower temperatures required for rime ice to form, it usually acreets right as it strikes the aircraft, at the stagnation point. This type of ice is porous and brittle due to trapped air pockets.
    - Mixed: combination of clear and rime icing features. This type of icing usually forms in the temperature range toward the middle of temperatures conducive to forming clear and rime ice.

    - ❏ What temperature ranges typically correspond to the formation of each of these types of structural ice? Clear: +2 to -10 degrees C. Mixed: -10 to -15 degrees C. Rime: -15 to -20 degrees C.

- ❏ How can you use the weather charts to determine whether there's a possibility of freezing rain along the route? Other than checking for thunderstorms and PIREPs, look for temperature inversions on the winds aloft coupled with precipitation on the radar summary, GFA, and/or METARs/TAFs.

- ❏ What are the different intensity levels of structural icing that pilots can report to ATC? Trace, Light, Moderate, Severe.

    - ❏ What defines each?
        - Trace: Ice is perceptible.
        - Light: Ice may create a problem if flight is prolonged. Occasional use of de/anti-icing removes/prevents accumulation. Icing does not present a problem if the de/anti-icing is used.
        - Moderate: Ice accumulation is such that even short encounters become potentially hazardous. Use of de/anti-icing equipment or flight diversion is necessary.
        - Severe: Immediate flight diversion necessary. De/anti-icing equipment fails to control the hazard.

<u>Fog/Mist</u>

- ❏ Explain every type of fog, and in particular, what causes each type to form.

    - Radiation fog: forms on clear nights with little to no wind when the ground cools rapidly due to terrestrial radiation causing the surrounding air temperature to cool to its dew point.
    - Advection fog: common in coastal areas with sea breezes (winds up to 15 kt are usually required), advection fog occurs when the wind pushes the layer of warm, moist ocean air over a cold terrestrial surface which cools the moist air to the dew point.
    - Upslope fog: occurs when wind forces moist, stable air up sloping land features like a mountain range until the moist air cools to the dew point.
    - Steam fog/sea smoke: forms when cold, dry air moves over warm water - as the water evaporates it rises and resembles smoke.
    - Ice fog: like radiation fog, except involving extremely cold, arctic temperatures that cause the water vapor in the air to form directly into ice crystals.

- ❏ Transcribe this METAR: *KYYQ 301300Z 35011KT 1/8SM FG VV001 02/02 A2991 RMK SLP131*

    - ❏ What is the ceiling? 100 feet. Any time there is completely obscuring phenomena (in this case fog), the Vertical Visibility (VV) is listed, and that becomes the ceiling.

- ❏ What kind of illusion would you expect when you're approaching to land and you enter fog? Entering fog gives the sudden feeling of pitching up, possibly leading the pilot to dangerously pitch the nose down.
    - ❏ What can you do to mitigate this illusion? Rely on your instruments, and use visual aids like PAPI's/VASI's.
- ❏ What's the difference between fog and a cloud? Fog is just a cloud that is on the surface.
- ❏ If the METAR shows a temperature of 5 degrees and a dew point of 4 degrees, what sort of weather would you expect? Visible moisture: mist, fog, clouds.

<u>Frost</u>

- ❏ What causes dew to form? Dew collects when a surface - like a blade of grass, or the skin of the airplane - cools below the dewpoint, causing the water vapor (i.e. the gas form of water) to condense (become a visible liquid).
- ❏ What causes frost to form on an airplane? Frost occurs when the temperature of the surface of the airplane cools below the dewpoint *and* below freezing (0 degrees C).
- ❏ On what type of nights is frost most likely to form? Cool, clear, calm nights with a low dew point.
- ❏ Why is it a bad idea to take off with frost on the wings? Because frost increases drag, adds to the plane's weight, changes the shape of the airfoil, and thus decreases lift. Also, it's illegal.
- ❏ What kind of drag does frost cause? Parasite - skin friction.

<u>Obstructions To Visibility (e.g. smoke, haze, volcanic ash, etc.)</u>

- ❏ What is smoke, and what causes it? Smoke is a suspension in the air of small particles produced by combustion due to fires, industrial burning, or other sources.
    - ❏ What makes it dangerous to pilots? It can reduce visibility, its compounds can be highly toxic or irritating, and it can contain carbon monoxide.
    - ❏ Why does smoke take longer to dissipate than fog or mist? Fog and mist can dissipate through evaporation or through the movement of air (wind); smoke doesn't dissipate - it requires the movement of air.

- ❏ What is haze? Haze is the suspension in the air of extremely small particles invisible to the naked eye and sufficiently numerous to give the air an opalescent (multi-colored, shimmering) appearance.
    - ❏ How does haze reduce visibility? By scattering light. Visibility in haze varies greatly, depending on whether the pilot is facing into or away from the sun. Above the definite ceiling of the haze layer the visibility is unrestricted, whereas at or below the ceiling the slant range visibility (air-to-ground) is poor.
    - ❏ How is haze different from mist and fog? In terms of density, haze is the least dense (increasing in density to mist, then fog). Also, haze appears blue or yellow, depending on the position of the sun, whereas mist and fog generally appear gray.
- ❏ Why is it dangerous to fly through volcanic ash? Volcanic ash is made up of fine particles of rock powder called “silica” (glass) that, if ingested by the engine, can melt and produce a soft sticky molten product that adheres to internal parts of the engine. Ash also causes abrasive damage to aircraft flying through it at hundreds of miles per hour - particles impacting the windshield can sandblast the surface into a frosted finish that obscures the pilot’s view.
    - ❏ Can ATC radar detect the presence of volcanic ash? No - *weather* radar can, though.

<u>Miscellaneous</u>

- ❏ What kind of weather would legally require us to be on an IFR flight plan in order to take off from a controlled airport (assuming no SVFR clearance)? Anything below VFR takeoff minimums - i.e., below either 3 SM *OR* 1000 foot ceiling when departing from a controlled airport.
    - ❏ What about from an uncontrolled airport? Visibility below 1 SM *OR* if you can’t maintain ‘clear of clouds’.
    - ❏ Show METARs with various weather and ask, “Could we take off VFR if this were the weather at our departure airport, or would we need to be on an IFR flight plan?”

<u>Alternates</u>

Brief primer/warning on the alternate rule: First of all, remember that filing an alternate is always required unless TWO conditions are met at the destination airport: 1) you have at least a 2000 foot ceiling and 3 sm visibility within +-1 hour of arrival, **and 2), the destination airport has an instrument approach procedure.** For some students it is easier to think of the alternate filing criteria inversely, i.e. in terms of when you MUST file an alternate: you must file an alternate if 1) within +-1 hour of arrival at your destination airport the weather is reported to be LESS than

2000 foot ceiling or less than 3 sm visibility, *or*, **2) the destination airport doesn't have any instrument approach procedures.**

- ❏ What is the definition of a *ceiling*? The FULL definition in part 1 of the FAR: *Ceiling* means the height above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as broken, overcast, or obscuration, and not classified as thin or partial.

- ❏ Can you file IFR to a VFR airport (an airport without IAPs)? Sure, you'll just need to file an alternate.

- ❏ On a day where the skies are clear, would you have to file an alternate if your IFR destination was an airport without an instrument approach procedure? Yes, because the airport doesn't have approaches.

- ❏ Can a VFR airport (no instrument approach procedure) ever be used as an alternate? Yes, as long as you can descend from MEA to land while maintaining basic VFR weather minimums.

- ❏ Can you use _____ airport for your alternate if the _____ approach is going to be in use and the weather at your ETA is _____? CHECK FOR NON-STANDARD ALTERNATE MINIMUMS FIRST! They are so common they're effectively standard.

- ❏ What factors should you consider when choosing an alternate airport?

    - Airport should be close enough to fly to and still have IFR legal fuel reserves remaining, yet far enough away that the weather will be different/better than the weather at the original destination airport.
    - Should have approaches, preferably precision or precision-like approaches that get you down the lowest.

- ❏ Inflight, the weather at your destination drops just below 2000 feet/3 sm within 1 hour of your ETA. Would you continue to your destination or are you required to divert to your alternate? Continue to destination. The 123 rule is for FILING on the IFR flight plan prior to the flight.

Task C. Cross-Country Flight Planning

References: 14 CFR part 91; AIM; Chart Supplements; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; IFR Enroute Charts; NOTAMS; IFR Navigation Charts

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with planning an IFR cross-country and filing an IFR flight plan.

Note: *Preparation, presentation, and explanation of a computer-generated flight plan is an acceptable option.*

Knowledge:	The applicant demonstrates understanding of:
IR.I.C.K1	Route planning, including consideration of:
IR.I.C.K1a	a. Available navigational facilities
IR.I.C.K1b	b. Special use airspace
IR.I.C.K1c	c. Preferred routes
IR.I.C.K1d	d. Primary and alternate airports
IR.I.C.K1e	e. Enroute charts
IR.I.C.K1f	f. Chart Supplements
IR.I.C.K1g	g. NOTAMS
IR.I.C.K1h	h. Terminal Procedures Publications (TPP)
IR.I.C.K2	Altitude selection accounting for terrain and obstacles, glide distance of airplane, IFR cruising altitudes, effect of wind, and oxygen requirements.
IR.I.C.K3	Calculating:
IR.I.C.K3a	a. Time, climb and descent rates, course, distance, heading, true airspeed, and groundspeed
IR.I.C.K3b	b. Estimated time of arrival, including conversion to universal coordinated time (UTC)
IR.I.C.K3c	c. Fuel requirements, including reserve
IR.I.C.K4	Elements of an IFR flight plan.
IR.I.C.K5	Procedures for activating and closing an IFR flight plan in controlled and uncontrolled airspace.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.I.C.R1	Pilot.
IR.I.C.R2	Aircraft.
IR.I.C.R3	Environment (e.g., weather, airports, airspace, terrain, obstacles).
IR.I.C.R4	External pressures.
IR.I.C.R5	Limitations of air traffic control (ATC) services.
IR.I.C.R6	Limitations of electronic planning applications and programs.

IR.I.C.R7	Fuel planning.

Skills:	The applicant exhibits the skill to:
IR.I.C.S1	Prepare, present, and explain a cross-country flight plan assigned by the evaluator including a risk analysis based on real time weather, which includes calculating time en route and fuel considering factors such as power settings, operating altitude, wind, fuel reserve requirements, and weight and balance requirements.
IR.I.C.S2	Recalculate fuel reserves based on a scenario provided by the evaluator.
IR.I.C.S3	Create a navigation plan and simulate filing an IFR flight plan.
IR.I.C.S4	Interpret departure, arrival, en route, and approach procedures with reference to appropriate and current charts.
IR.I.C.S5	Recognize simulated wing contamination due to airframe icing and demonstrate knowledge of the adverse effects of airframe icing during pre-takeoff, takeoff, cruise, and landing phases of flight as well as the corrective actions.
IR.I.C.S6	Apply pertinent information from appropriate and current aeronautical charts, Chart Supplements; Notices to Air Missions (NOTAMs) relative to airport, runway and taxiway closures; and other flight publications.

Nav Log/General

- ❏ Go through the first row of your cross country nav log, and describe how you calculated each number.
- ❏ How did you calculate your initial climb TAS? (To calculate TAS accurately during a climb, derive it using the average pressure altitude and temp over the course of the climb.)
- ❏ Define IAS, CAS, TAS, GS.
- ❏ Are the airway courses depicted on the low enroute chart magnetic or true?
- ❏ Where and how did you calculate our IFR fuel reserve?
- ❏ Approaching the VOR, ATC tells you, “Cessna 976SP, due to delays at your destination airport, you can expect to hold over the VOR for approximately two hours. Advise if able to accept.” Will you accept? Explain. Calculate the expected fuel burn and determine whether, after holding for two hours, you would still have enough fuel to continue to your destination airport, then fly for 45 minutes at normal cruise. The math is straightforward: multiply your cruise GPH by 2 and subtract this number from your original total fuel remaining. Make sure that this final number is more than ¾ of the cruise GPH.
- ❏ How do you close your IFR flight plan at towered and non-towered airports?

DPs (Both FAA and Jeppesen versions of DPs are provided below. Questions and/or answers specific to only one type of chart are denoted as such.)

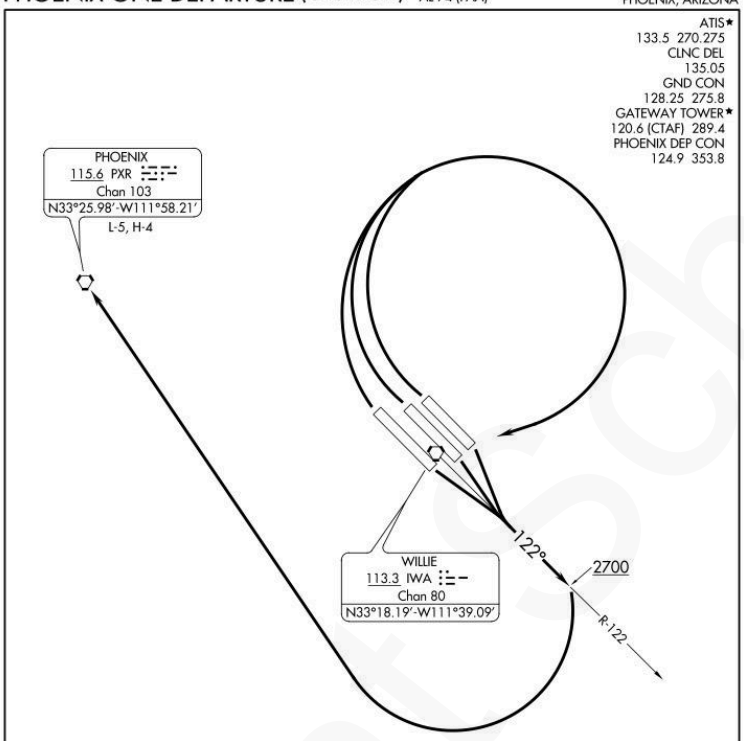
(PXR1.PXR) 18088

PHOENIX ONE DEPARTURE (OBSTACLE)

AL-74 (FAA)

PHOENIX-MESA GATEWAY (IWA)
PHOENIX, ARIZONA

SW-4, 02 DEC 2021 to 30 DEC 2021



SW-4, 02 DEC 2021 to 30 DEC 2021

TAKEOFF MINIMUMS

Rwys 12L, 12C, 12R, 30L, 30C, 30R: Standard.

TAKEOFF OBSTACLE NOTES

Rwys 30L/C/R: Trees beginning 351′ from DER, 351′ left of centerline, up to 20′ AGL/1359′ MSL.
Trees beginning 689′ from DER, 398′ right of centerline, up to 20′ AGL/1359′ MSL.

NOTE: Chart not to scale.

DEPARTURE ROUTE DESCRIPTION

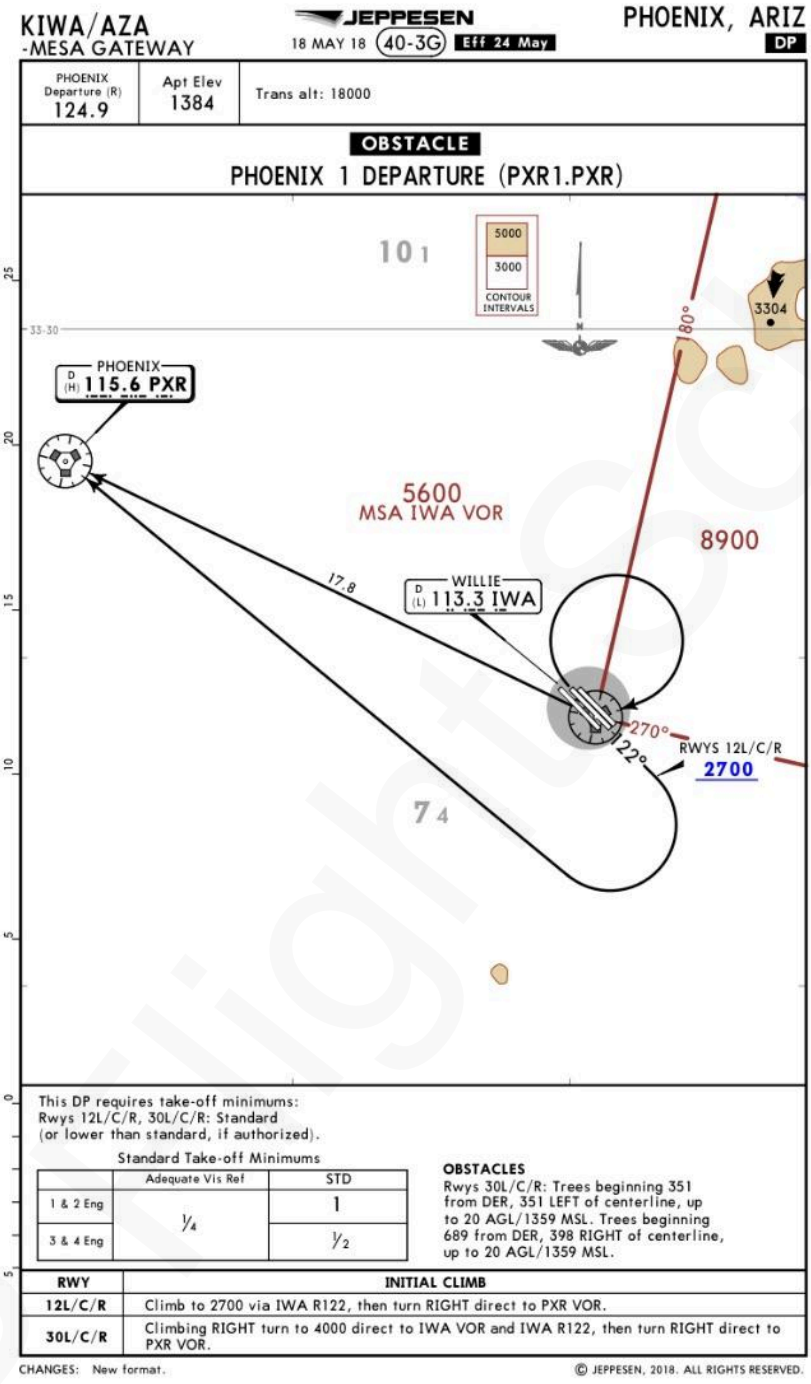
TAKEOFF RUNWAYS 12L/C/R: Climb to 2700 via IWA VORTAC R-122 then right turn direct PXR VORTAC.

TAKEOFF RUNWAYS 30L/C/R: Climbing right turn to 4000 direct IWA VORTAC and IWA VORTAC R-122 then right turn direct PXR VORTAC.

PHOENIX ONE DEPARTURE (OBSTACLE)

(PXR1.PXR) 11FEB10

PHOENIX, ARIZONA
PHOENIX-MESA GATEWAY (IWA)



- ❏ Is the Phoenix One Departure a SID or ODP? ODP.
  - ❏ How can you tell? "Obstacle" in the title.
- ❏ What are some of the differences between SIDs and ODPs?
- ❏ What climb gradient is required to fly this DP? 200 feet/nm. How do you know? There's no climb gradient specified, so it's standard: 200 feet/nm.

- ❏ You take off on the PXR1.PXR but right after lift-off the tower starts giving you vectors instead. What minimum climb gradient are you now expected to achieve? Explain. 250 feet/nm due to the diverse vectoring area (DVA).
- ❏ Where is information about Takeoff Minimums, DVAs, and textual ODPs located? Jeppesen: On the Airport Information page. FAA: In the Takeoff Minimums section of the TPP (on Foreflight, this information is listed under Procedure>Departure>TAKEOFF MINIMUMS).
- ❏ What climb *rate* is required for a minimum climb *gradient* of 250 feet/nm at a ground speed of 80 knots?
- ❏ Using present weather conditions, will we be able to maintain this feet/min climb to 3000 feet? Prove it.
- ❏ When you see “standard” written on an ODP, what does this mean? It is referring to the standard visibility weather minimums for 121/135. It does not mean a 200 feet/nm climb gradient. Hence the reason some ODPs read, say, “Standard with minimum 250 feet/nm climb to 5000.” Clearly this does not mean, “200 feet/nm climb with minimum 250 feet/nm climb to 5000.” The way you can tell that the climb gradient is the standard 200 feet/nm is when it is not depicted at all.
- ❏ What are standard 121/135 weather minimums? 1 sm if the plane has 2 or fewer engines; ½ sm if the plane has more than 2 engines.
- ❏ Jeppesen: What is meant by “Adequate Vis Ref”? Explain how this works. The Adequate Visual Reference visibility pertains to Part 121 and 135 operators. It means that if runway markings or runway lighting provides the pilot with adequate visual reference to continuously identify the take-off surface and maintain directional control throughout the take-off run, *and* if the company’s OpsSpecs are FAA approved to allow it, then the pilot may depart with visibility as low as that listed for Adequate Vis Ref.
- ❏ Take me through your options for picking up an IFR clearance out of a non-towered airport. Most common (and preferred, when available, as it mitigates rushing to beat the clearance void time): call up the controlling agency in the plane while on the ground with the engines running. Other options: National IFR clearance hotline: 1-888-766-8267; or call a briefer/FSS. Refer to the Chart Supplement for airport-specific clearance information.
- ❏ You want to pick up your IFR clearance in the plane at KHII. Who would you call, what frequency would you use, and what would you say? Could try LA Center on 134.65 in the plane, or follow the Chart Supplement’s guidance and contact LA center on the phone on 661-575-2079. *“LA Center, Cessna 976SP is on the ground at KHII, we’d like to pick up our IFR clearance to KIWA.”*
- ❏ Center gives you a clearance void time. Are you required to be off the ground by that time, or is the requirement that you’ve departed and contacted LA Center by that time? Off the ground.
- ❏ What kind of weather is required to fly the VCOA out of KHII? 1500 foot AGL ceiling - 3 sm visibility.
- ❏ Do you need to inform ATC or will they propose it? Inform them.
- ❏ How would you fly it? As described in the takeoff minimums, ODPs, DVAs section of the TPP (or at the bottom of the Jeppesen KHII Airport Information page): After departure,

circle back over the airport and climb while circling to at or above 2300 feett MSL, then proceed northwest and intercept EED VORTAC R-138 to EED VORTAC, continue climb in EED VORTAC holding pattern (East, right turns, 257° inbound) to cross EED VORTAC at or above 6100 feet before proceeding on course.

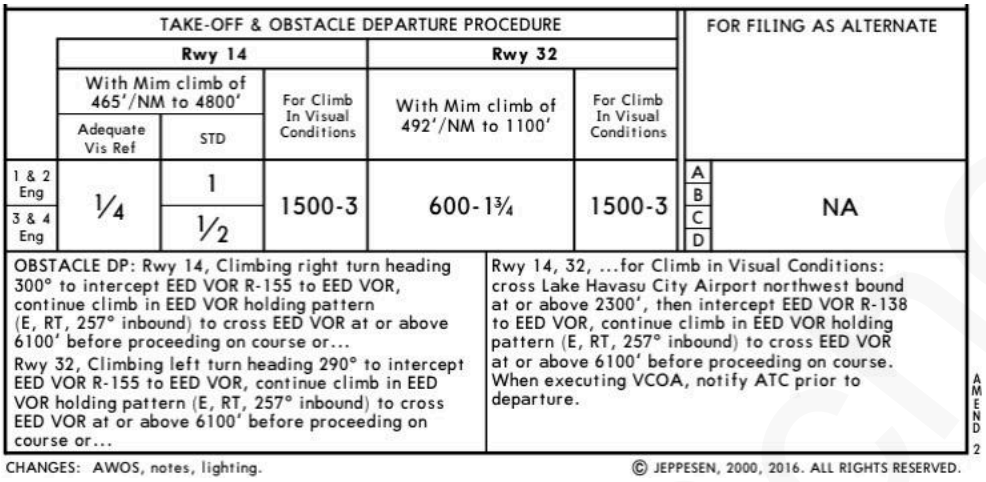
Scenario: Center gives you the following clearance: *"Cessna 976SP, cleared to KIWA via EED V12 DRK V105 PXR Direct SNOWL, climb maintain 11,000...."* It's night out, the ceiling is 1000 feet OVC, 2 sm visibility. You're departing RWY32.

- ❏ How are you going to navigate to EED? Fly the ODP (posted below). DO NOT go direct.

FAA:

LAKE HAVASU CITY, AZ
LAKE HAVASU CITY (HII)
TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES
AMDT 2 12152 (FAA)
TAKEOFF MINIMUMS: ***Rwy 14,*** *std. w/min. climb of 465' per NM to 4800, or 1500-3 for climb in visual conditions.* ***Rwy 32,*** *600-1¾ w/min. climb of 492' per NM to 1100, or 1500-3 for climb in visual conditions.*
DEPARTURE PROCEDURE: ***Rwy 14,*** *climbing right turn heading 300° to intercept EED VORTAC R-155 to EED VORTAC, continue climb in EED VORTAC holding pattern (East, right turns, 257° inbound) to cross EED VORTAC at or above 6100 before proceeding on course or ...*
Rwy 32, *climbing left turn heading 290° to intercept EED VORTAC R-155 to EED VORTAC, continue climb in EED VORTAC holding pattern (East, right turns, 257° inbound) to cross EED VORTAC at or above 6100 before proceeding on course or. ..*
Rwys 14, 32*, ... For climb in visual conditions: cross Lake Havasu City airport northwest bound at or above 2300, then Intercept EED VORTAC R-138 to EED VORTAC, continue climb in EED VORTAC holding pattern (East, right turns, 257° inbound) to cross EED VORTAC at or above 6100 before proceeding on course. When executing VCOA, notify ATC prior to departure.*
TAKEOFF OBSTACLE NOTES: ***Rwy 14,*** *pole 3327' from DER, 46' right of centerline, 107' AGL/868' MSL. Poles 3468' from DER, 195' left of centerline, up to 107' AGL/890' MSL. Trees/bushes 976' from DER, 380' left of centerline, up to 46' AGL/829' MSL. Terrain 143' from DER, 346' left of centerline, up to 804' MSL.* ***Rwy 32,****trees 1544' from DER, 416' right of centerline, up to 44' AGL/793' MSL.*

Jeppesen (bottom section of the Airport Info page):



TAKE-OFF & OBSTACLE DEPARTURE PROCEDURE

	Rwy 14			Rwy 32		FOR FILING AS ALTERNATE	
	With Mim climb of 465'/NM to 4800'		For Climb In Visual Conditions	With Mim climb of 492'/NM to 1100'	For Climb In Visual Conditions		
	Adequate Vis Ref	STD					
1 & 2 Eng	1/4	1	1500-3	600-1¾	1500-3	A B C D	NA
3 & 4 Eng		1/2					

OBSTACLE DP: Rwy 14, Climbing right turn heading 300° to intercept EED VOR R-155 to EED VOR, continue climb in EED VOR holding pattern (E, RT, 257° inbound) to cross EED VOR at or above 6100' before proceeding on course or...

Rwy 32, Climbing left turn heading 290° to intercept EED VOR R-155 to EED VOR, continue climb in EED VOR holding pattern (E, RT, 257° inbound) to cross EED VOR at or above 6100' before proceeding on course or...

Rwy 14, 32, ...for Climb in Visual Conditions: cross Lake Havasu City Airport northwest bound at or above 2300', then intercept EED VOR R-138 to EED VOR, continue climb in EED VOR holding pattern (E, RT, 257° inbound) to cross EED VOR at or above 6100' before proceeding on course. When executing VCOA, notify ATC prior to departure.

AMEND 2

CHANGES: AWOS, notes, lighting.

- ❏ You're departing during the summer, the temperature is 35 degree C, and the altimeter is 29.82. You're taking off into a slight headwind. Would you fly this ODP? Why or why not? Convert 492 feet/nm to feet/minute. Then calculate your expected feet/minute climb rate using the performance charts and confirm that you will safely be able to achieve the required performance.
- ❏ Do you need a clearance to fly an ODP? No, although it's always a good idea to inform the controlling agency that you'll be flying the ODP.
  - ❏ What if your departure clearance is instead to fly runway heading then expect radar vectors to EED - can you still take the initiative and fly the ODP? No, you must fly what you've been assigned.
- ❏ What does DER mean on the ODP? Departure end of runway.
- ❏ Departures require you to clear the departure end of the runway by a minimum of how many feet AGL? 35 feet.
- ❏ On an IFR departure, to what minimum altitude must you climb before making your first turn? 400 feet AGL.
- ❏ After departure, what would your initial call to LA Center sound like?
  - ❏ Departure replies, *"Cessna 976SP, radar contact…"* Is obstacle clearance their responsibility now? No, not unless they give you a vector.
- ❏ Draw the hold for this KHII ODP. What hold entry will you use?

<u>Low Enroute Charts</u>

Students must be able to identify and explain all Low Enroute Chart symbology. The following symbology has been a historically weak area:

- ❏ White vs. brown-shaded areas; blue vs. green vs. brown airports; airport symbols with the tick marks extending out from them vs. the circle symbols; VOR-to-VOR DME (boxed DME) vs. VOR-to-fix DME (DME with arrow) vs. fix-to-fix DME (just the DME number); MOCAs vs. MEAs vs. OROCAs/MORAs vs. MRAs vs. MCAs vs. MTAs vs. MAAs; grid MORAs vs. route MORAs (Jeppesen only) and how they're derived, as well as why some are green

and some are maroon; interpret all the information in the Airport Data Block; Ts on either side of fixes that represent MEA changes; class B vs. C symbology; ARTCC box; RCOs; compulsory reporting points (remember, not mandatory unless you've heard previously: "radar contact has been lost"); symbols representing different types of VORs; SFRA/Grand Canyon boundary; ILS feather; MTRs; (T) vs (L) in VOR box; NDBs.

- ❏ The low enroute chart shows airspace up to but not including what altitude? 18,000 feet MSL.
- ❏ What is the purpose of an M.O.A.? To separate military traffic from IFR traffic.
- ❏ You've departed ABQ westbound and you're on V12 established at your last assigned altitude, 9000, approaching CARTY. You're on with Albuquerque Center. What are you going to do? REQUEST a higher altitude, 10,000 feet minimum, due to the MCA.
  - ❏ Are you going to ask for approval from ATC before initiating that climb, or would you take the initiative and start climbing? Get ATC approval first.
  - ❏ If ATC assigns altitudes that keep you above MCAs, why are MCAs even depicted? In other words, when is MCA information useful to pilots? Loss of communication, situational awareness, or if ATC makes a mistake and forgets to assign a climb.
  - ❏ Y ou've lost communications and there's no MCA at the next fix. You cross the fix at 8,000 feet and start your climb to the MEA for the next route segment, 10,000 feet. What climb gradient must be maintained in order to guarantee obstacle clearance? Why? 120 feet/nm. (The rule is 150 feet/nm < 5000 MSL. 120 feet/nm from 5000 - 10,000. 100 feet/nm > 10,000.)
- ❏ When you cross INW enroute to KABQ are you required to make a position report? No, only if out of radar contact.
  - ❏ What does "out of radar contact" mean? You're not showing up on ATC's radar.
  - ❏ How would you know that you've lost radar contact? ATC will inform you: *"Cessna 976SP, radar contact lost."*
  - ❏ ATC tells you that radar contact has been lost. You're crossing INW and now turning eastbound onto V12 enroute to KABQ. Simulate a position report to Albuquerque Center.
- ❏ Do any of the IFR altitudes guarantee communication coverage? No.
- ❏ You're on V190 westbound toward PXR at 5,300 and you've just crossed ZERLO. Are you guaranteed navigational coverage on this segment between ZERLO and LAKEY? Not for the first 2 miles of the segment; yes for the next 5 miles (because you'd be within 22 nm of the VOR).
- ❏ Give me some examples of when you would use the OROCA/Grid MORA or an MSA. Emergencies that occur off-route (meaning while you're not established on a published route segment). E.g., hypoxia, icing, lost communications in IMC.

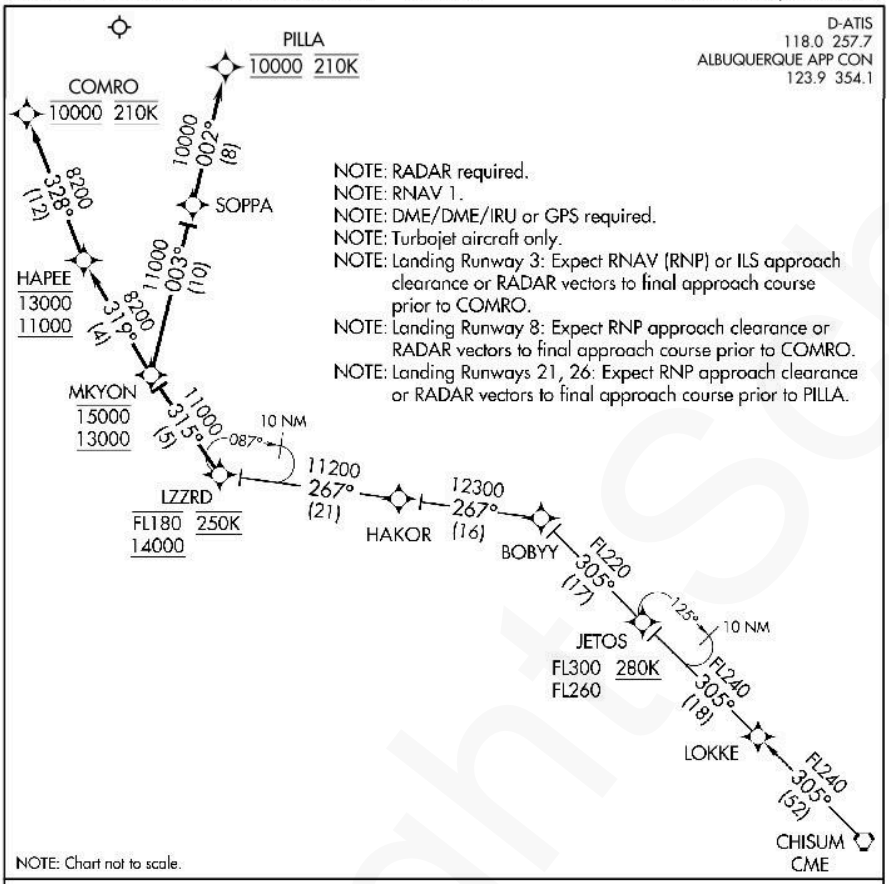
STARs (Both FAA and Jeppesen versions of STARs are provided below. Questions and/or answers specific to only one type of chart are denoted as such.)

(LZZRD.LZZRD3) 17117

LZZRD THREE ARRIVAL (RNAV)

AL-12 (FAA)

ALBUQUERQUE INTL SUNPORT (ABQ)
ALBUQUERQUE, NEW MEXICO



SW-1, 04 NOV 2021 to 02 DEC 2021

SW-1, 04 NOV 2021 to 02 DEC 2021

ARRIVAL ROUTE DESCRIPTION

CHISUM TRANSITION (CME.LZZRD3)

From LZZRD on track 315° to cross MKYON between 13000 and 15000.

LANDING RUNWAY 3: From MKYON on track 319° to cross HAPEE between 11000 and 13000, then on track 328° to cross COMRO at 10000 and at 210K. Expect RNAV (RNP) or ILS approach or RADAR vectors to final approach course.

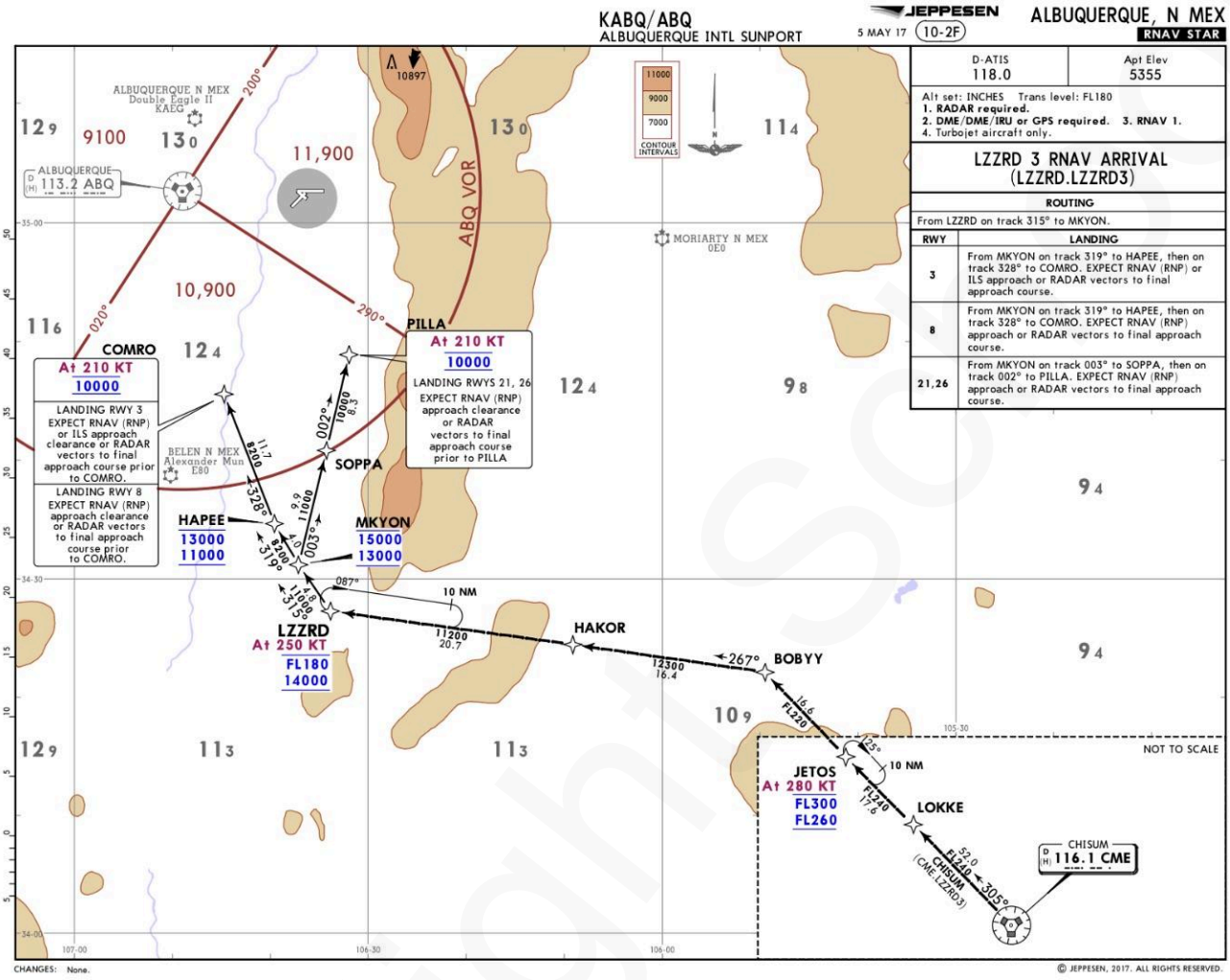
LANDING RUNWAY 8: From MKYON on track 319° to cross HAPEE between 11000 and 13000, then on track 328° to cross COMRO at 10000 and at 210K. Expect RNAV (RNP) approach or RADAR vectors to final approach course.

LANDING RUNWAYS 21/26: From MKYON on track 003° to SOPPA, then on track 002° to cross PILLA at 10000 and at 210K. Expect RNAV (RNP) approach or RADAR vectors to final approach course.

LZZRD THREE ARRIVAL (RNAV)

(LZZRD.LZZRD3) 08JAN15

ALBUQUERQUE, NEW MEXICO
ALBUQUERQUE INTL SUNPORT (ABQ)



Clearance: *"Cessna 976SP, ABQ Center, proceed direct CHISUM. Maintain FL280 to CHISUM. Cleared LZZRD THREE arrival into KABQ."*

- ❏ Provided the aircraft has supplemental oxygen, if you receive a clearance for this arrival, can we accept it? No, turbojet only.
- ❏ If you are flying a turbojet, with the above clearance, to what altitude will you either maintain or descend after crossing CHISUM? FL280.
  - ❏ How about after crossing LOKKE? FL280
- ❏ What phrase must you hear before descending along an arrival? "Descend via…"
- ❏ Different clearance, *"Cessna 976SP, ABQ Center, proceed direct CHISUM. Maintain FL280 until crossing CHISUM. Descend via the LZZRD THREE arrival."* How does this change how you will fly the arrival? Now you can laterally AND vertically track the arrival.
- ❏ To what altitude(s) will you descend after crossing CHISUM and LOKKE now? The only restriction is that you must cross JETOS between FL300 and FL260. So when crossing CHISUM and LOKKE you must still be between those altitudes.
- ❏ What does "RADAR required" on arrival, departure, and approach plates mean?

- ❏ Are the waypoints on this arrival fly-by or fly-over?
- ❏ How can you differentiate between MEAs and Minimum/Maximum/Mandatory Attitudes on an arrival plate? The min/max/mandatory altitudes have bars either below, above, or above and below them.
- ❏ What does 'STAR' stand for?
- ❏ When you hear, "cleared for the _____ arrival, _____ transition," what does the "_____ transition" part mean? This is a connecting point. It is where you transition onto an arrival from your prior route; or on a DP, it's where you transition off of the departure and onto the next part of your route.
- ❏ Some arrivals like the BRUSR ONE (RNAV) into KPHX have flight track segments composed of dots (this is specific to FAA arrival plates, not Jeppesen). What does this signify? Lost communications flight track.
- ❏ How does Jeppesen depict lost communication procedures on arrivals, if at all? Jeppesen includes a 'Lost Communications' box on the arrival plate.

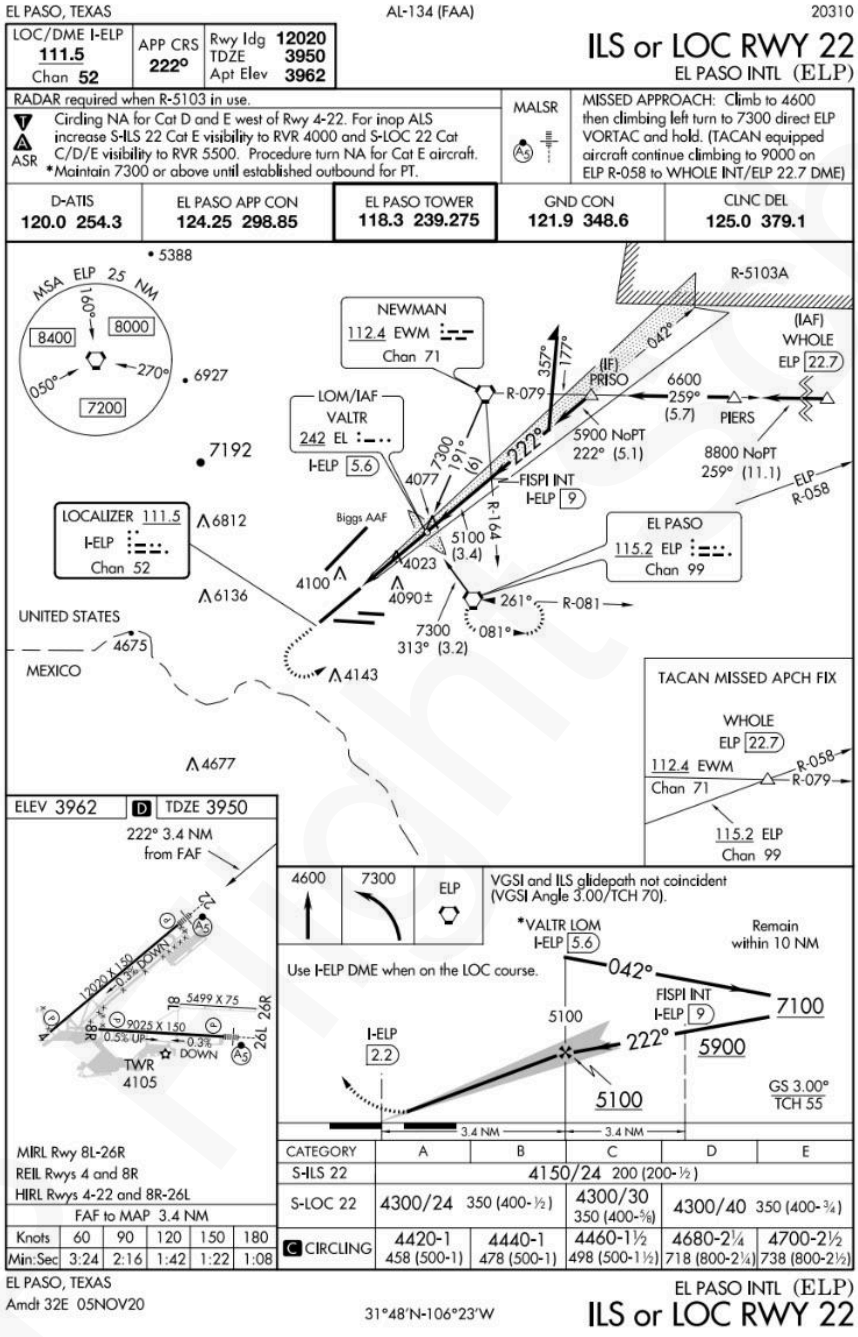
Instrument Approach Procedures (Both FAA and Jeppesen versions of IAPs are provided below. Questions and/or answers specific to only one type of chart are denoted as such.)

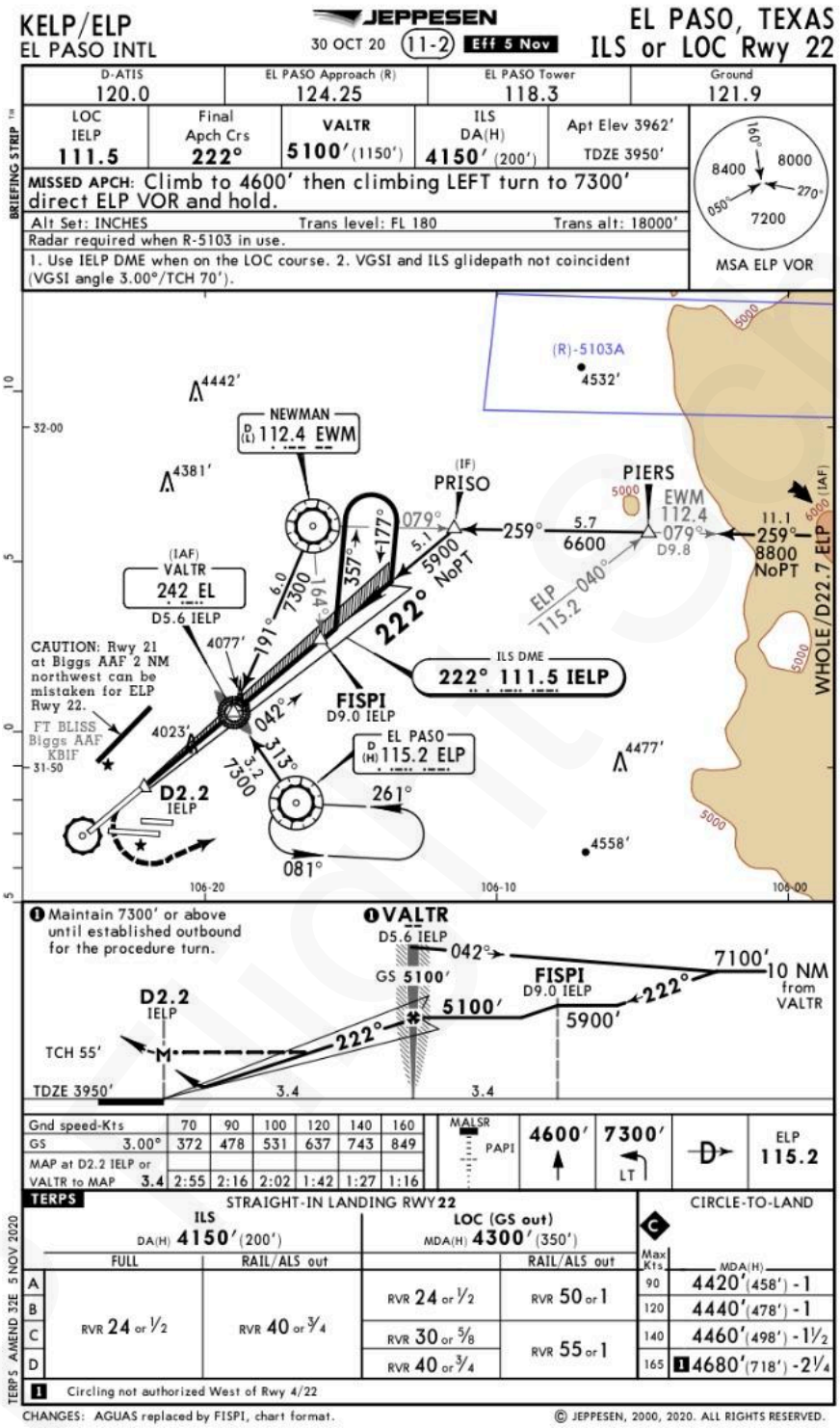
- ❏ Identify and explain all symbology found on the approach plates below.
- ❏ After being cleared for a visual approach, must you maintain your last assigned altitude or can you initiate your descent into the airport? You can descend.
- ❏ There are some clouds between you and the airport. Once cleared for the visual approach do you have to circumvent them or can you fly through them? You have to maintain 'clear of clouds'.
- ❏ Do you have to maintain the basic VFR cloud clearances on a visual approach? No, you just have to be clear of clouds.
- ❏ What are the requirements to receive a visual approach clearance? Weather-wise: 1000 foot ceiling and 3 sm visibility reported at the destination airport. The pilot must have the destination airport or the preceding aircraft in sight.
- ❏ What is a contact approach?
  - ❏ When and why would you use it?
  - ❏ How would you go about getting cleared for one?
  - ❏ What are the weather requirements for a contact approach?
- ❏ Tower clears you for an RNP approach, can you accept?
- ❏ What are the segments of an instrument approach? Explain each.

The following is an example approach clearance and line of questioning an instructor might use while their student finger flies the approach:

"Cessna 976SP, proceed direct EWM, maintain 8000 'til crossing EWM, cleared ILS Runway 22 into KELP." Use the approach plate to finger fly and explain every step of how you would fly this approach. (Tip: don't skip the procedure turn. Being aligned straight-in is different from receiving

a “cleared straight in” approach clearance. The former does not, by itself, allow you to bypass the PT.)





- ❏ Given your clearance, what altitude will you fly until reaching the EWM VOR? 8000 feet.
- ❏ What if instead of the previous clearance, you were instructed, *"Cessna 976SP, proceed direct EWM, cleared ILS Runway 22 approach into KELP."* So this time there's no specified altitude assignment. Say that when you received the clearance your altitude was 8000 feet.

Now what altitude would you maintain or descend to while enroute to EWM? Maintain 8000 feet. You're cleared, but not established, on a segment of the approach. So maintain the last assigned altitude.

- ❏ What are you going to do after crossing EWM in terms of course and altitude? Track outbound on the EWM 191 radial and descend to 7300 feet.
  - ❏ What tells you that this radial is a feeder segment of the approach and not just a cross radial? It's depicted as slightly more bold than the cross radials. Also, it has an altitude co-located.
- ❏ When can you descend below 7300 feet and to what altitude will you descend? After crossing VALTR, once established outbound in the PT - descend to 7100 feet.
- ❏ How will you know you've reached VALTR? The localizer will center.
- ❏ What are some other ways to identify VALTER? Outer marker, DME (from the localizer), and the GPS will identify the fix.
- ❏ What is an LOM? Stands for Locator Outer Marker. It's an Outer Marker coupled with an NDB (non-directional beacon).
- ❏ So you've crossed VALTR, what's next? Turn outbound, 042 on the localizer course. Descend to 7100 feet.
- ❏ For how long will you fly outbound? 2 minutes works well. Not mandatory.
- ❏ What is your distance limitation on the PT outbound? 10 nm from VALTR.
- ❏ How will you reverse course in order to re-establish yourself inbound? Fly 357 outbound for one minute, then make a *right* 180 degree turn to re-establish yourself inbound.
- ❏ Are you required to fly 357? No, the heading is recommended. The barb/procedure turn depiction simply indicates the protected side.
- ❏ For how long will you fly your 357 course reversal heading? Recommended one minute.
- ❏ After that will you make a left or right turn to re-intercept the localizer? Recommended to the right - that way re-intercepting the inbound course too close to FISPI (or the FAFs on other approaches) won't be an issue.
- ❏ When can you descend below 7100 feet? Once re-established inbound.
- ❏ To what altitude? 5900 feet.
- ❏ How can you tell you're established? Course alive.
- ❏ When can you descend below 5900 feet? Once you've crossed FISPI.
- ❏ How will you know that you've crossed FISPI? DME (from the localizer).
- ❏ What are some other ways to identify this fix? 164 cross-radial off EWM, radar ID, GPS.
- ❏ To what altitude will you descend after crossing FISPI? 5100 feet.
- ❏ What is your FAF on this approach? Glideslope intercept.
  - ❏ Not VALTR? Not VALTR (although they happen to be co-located) - that's the FAF on the LOC22 approach.
- ❏ What is the glideslope descent angle on this approach? 3 degrees.
- ❏ What descent rate will you use once established, and how did you calculate it? Simply interpolate with Jeppesen - the numbers are provided on the plate. If using FAA plates, either use a rule of thumb calculation (e.g. ground speed divided by 2, tack on a 0 at the end, then add 50. So, say, 80 knots/2 = 40. Tack on a 0, so 400. Then add 50, so 450 fpm,

or just use the chart in the digital terminal procedures supplemental for the exact number. Students should either know this number beforehand or be able to quickly calculate it.

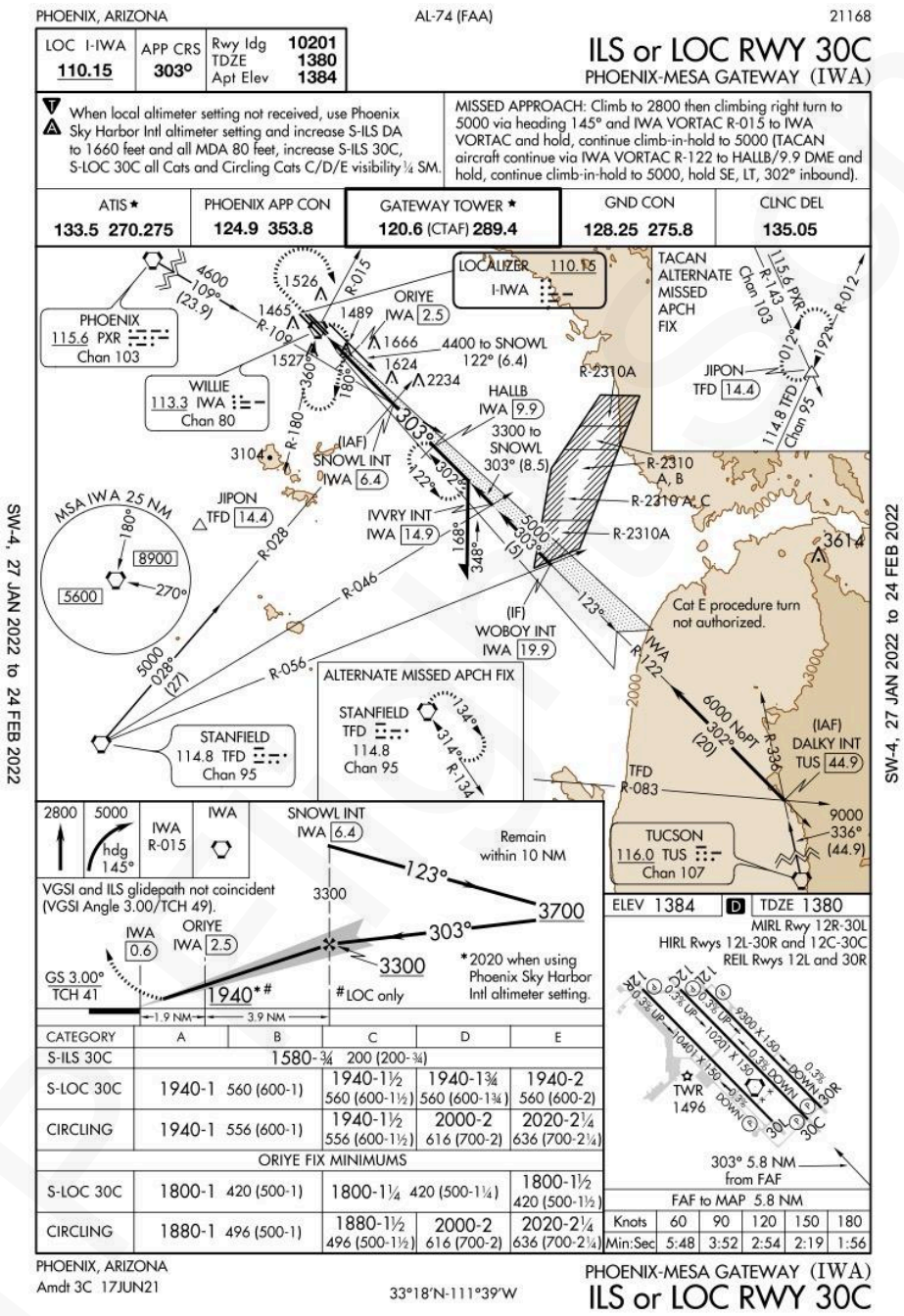
- ❏ After intercepting glideslope, to what altitude can you descend? 4150 feet.
- ❏ What's that altitude called? DA - Decision Altitude.
- ❏ Is this the altitude at which you make your decision to go missed and thus descend slightly below it during the time that you are adding power and initiating a climb pitch? Or will you start going missed just before reaching your DA so that the plane never descends below the DA? This is the DECISION altitude. It is expected that you will descend slightly below the DA during the time it takes to initiate the go around.
- ❏ Upon reaching your DA you only have a taxiway and the control tower in sight, can you continue your descent and land? No, these are not listed under 91.175.
- ❏ What is required under 91.175 in order to continue your descent below DA/MDA? List 91.175 (should be verbatim).
- ❏ What type of visibility is required here? Flight visibility from the cockpit, or ground visibility reported on the ATIS? Flight visibility.
- ❏ Convert 2400 RVR into SM (statute miles). ½.
- ❏ FAA plate-specific: If the required visibility were 1800 RVR, what SM flight visibility would be required? ½ still, per the chart in the digital terminal procedures supplemental.
- ❏ Let's say you're in 'heavy' IMC - which lights would you expect to see first? MALSR.
- ❏ Is the MALSR pilot controlled? No, the ALS symbol isn't shaded black (FAA). For Jeppesen there would be a note on the Airport Information page explaining how to turn on the ALS.
- ❏ What if the MALSR is inoperative - by how much does the flight visibility requirement increase? +¼ sm, per the table in the Digital Terminal Procedures Supplemental (FAA). For Jeppesen, the approach plate plainly states the new visibility.
- ❏ The MALSR is in sight - what exact altitude can you descend to now? 100 feet above TDZE, so 4050 feet MSL.
- ❏ What do you need before you can descend below that altitude? One of the other visual items listed in 91.175 - and you still must be able to make a normal descent to land while maintaining the required flight visibility.
- ❏ You're approaching glideslope intercept and you notice that your glideslope never comes alive, what are you going to do? Report the failed navigation equipment per 91.187 and switch to the localizer only approach - use MDA minimums.
- ❏ Do you now have to get an additional clearance for the Localizer approach, or when you were cleared for the ILS does that clearance still suffice? The original ILS clearance still suffices - you were cleared for the entire 'plate' when you were cleared for the ILS.
- ❏ What is your FAF on the LOC22? VALTR.
- ❏ On this LOC22 approach, to what altitude will you descend after crossing VALTR? 4300 feet if on a straight in approach.
- ❏ What do we call that altitude? MDA, Minimum Descent Altitude.
- ❏ When you get to that altitude will you level off or execute a missed approach procedure as soon as you reach it? Level off at MDA until the MAP.
- ❏ What is your missed approach point (MAP) on the Localizer approach? 2.2 DME from the localizer.

- ❏ Is DME required for this approach? No.
- ❏ So how would you know when to execute a missed approach procedure if you didn't have DME? Time. Or ask ATC.
- ❏ Are these MAP speeds depicted in ground speed or KIAS? Ground speed (this is clear if using Jeppesen).
- ❏ What is your VDP (visual descent point) on this approach? 351/300 = Approximately 1.2 nm from the approach end of Runway 22, so I-ELP 3.4.
- ❏ If you don't have 91.175 requirements by the VDP are you going to go missed right there, or would you hold the MDA until your MAP? Hold until your MAP.
- ❏ Simulate a missed approach call. *"El Paso Tower, Cessna 976SP is going missed, request…"* Here you generally have three options: You can request 1) to fly the published missed, 2) vectors for a different approach into the same airport, or 3) to proceed to an alternate airport.
- ❏ To whom would you make this call if going missed at a non-towered airport? The controlling agency (i.e., Center or Approach).
- ❏ What standard climb gradient on a missed approach guarantees obstacle clearance? 200 feet/nm.

Additional questions about this approach:

- ❏ What is your decision height? 200 feet AGL.
- ❏ How is this different from decision altitude? DA is MSL, DH is AGL.
- ❏ You said that the REILs qualify as part of the runway environment - what are REILs, what do they look like? Flashing white lights on both sides of the approach end of the runway.
- ❏ What is the definition of Touchdown Zone Elevation? The highest elevation in the first 3000 feet of the landing zone.
- ❏ Why is it helpful to know your DH (as opposed to the DA) when you're on an approach in IMC? DH is AGL and therefore matches up with how cloud ceilings are reported.
- ❏ Pretend that during your set-up for the approach you listen to the ATIS and hear that the ceiling and visibility are below minimums for the approach, can you still legally fly the approach? Yes, although depending on just how low or thick the IMC is, continuing with the approach might demonstrate poor ADM.
- ❏ You're on the Localizer 22 approach. Tower tells you to circle southeast of the field for Runway 8. While circling to land you drop the right wing to turn and briefly lose sight of the runway when the wing blocks your view. Do you have to execute a missed approach procedure? No, per 91.175(e).
- ❏ How many feet of obstacle clearance are you guaranteed while circling right at minimums? 300 feet.
- ❏ Now let's say you're halfway through your right circle-to-land downwind and you lose sight of the runway due to IMC. How exactly are you going to go missed here, seeing as you're past the MAP? Make an immediate climbing right turn over the runway and join the missed approach course.

For additional practice: *“Cessna 976SP, cleared direct TFD, maintain 6000 until crossing TFD, cleared ILS30C into KIWA.”* Finger-fly and explain every step of how you would fly this approach:

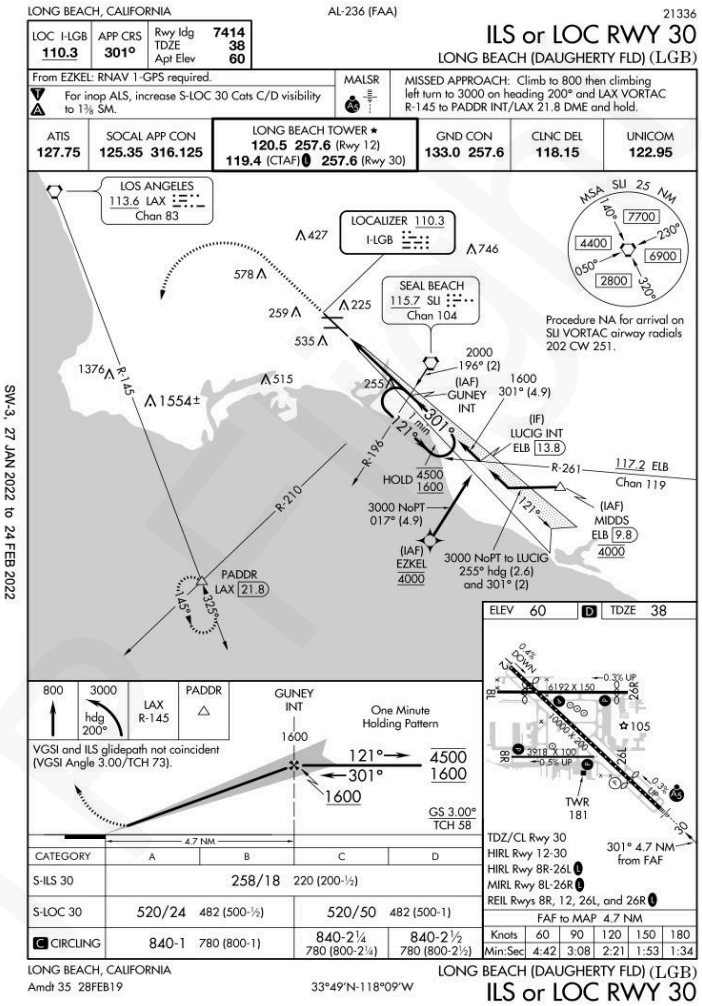


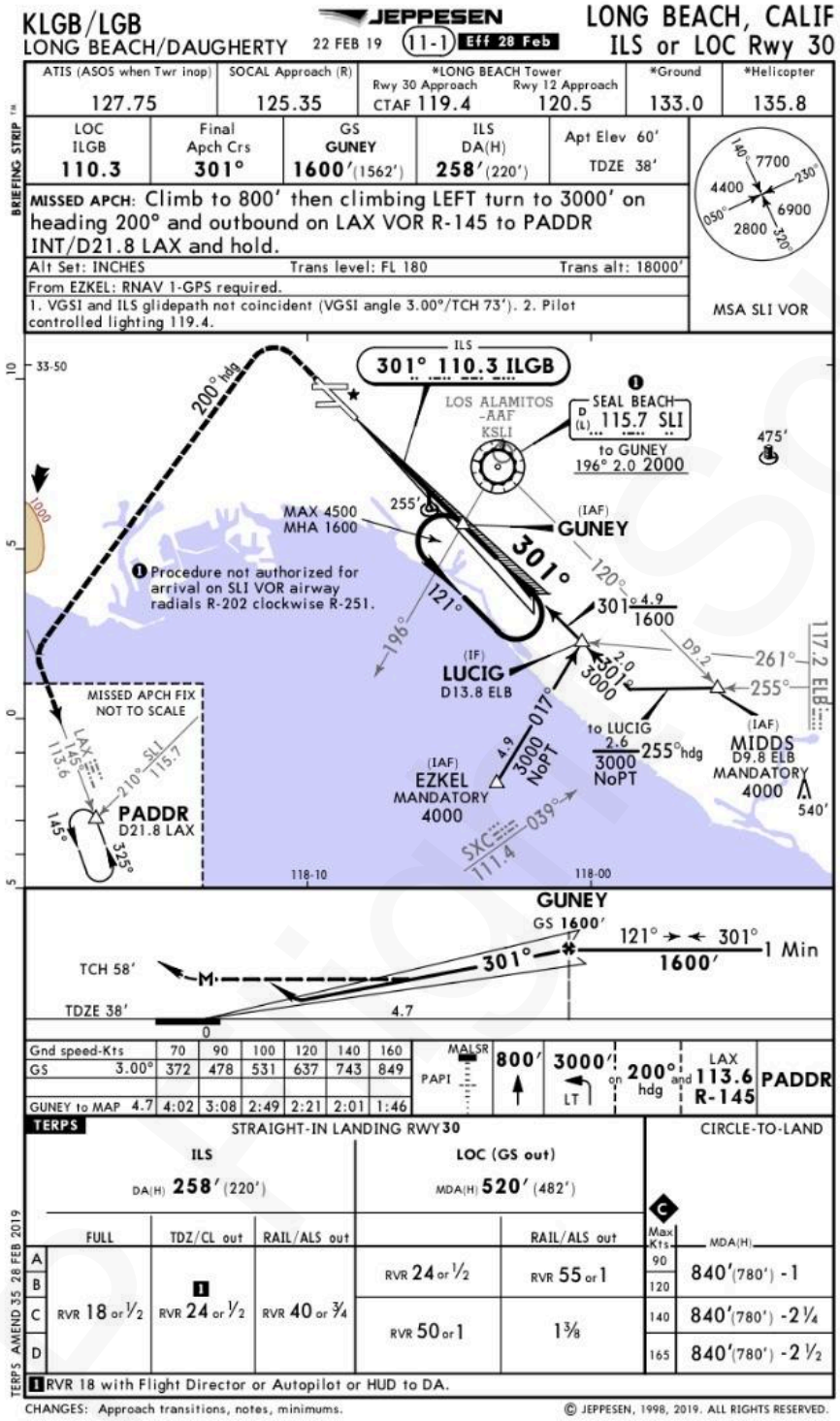
This approach offers a few additional nuances:

- ❏ Are the DME fixes (SNOWL, ORIYE, D0.6) based on DME from the localizer or the VOR? VOR.

- ❏ On the straight-in localizer approach, to what altitude would you descend after crossing SNOWL? 1940 feet.
  - ❏ What if you never switched over to KIWA's altimeter setting and were still using Phoenix Sky Harbor's altimeter setting? Now what altitude would you descend to immediately after crossing SNOWL? 2020 feet, per the "*" (FAA), or the negative 2 circle (Jeppesen).
- ❏ When, if at all, can you descend further? If you have DME then you can identify ORIYE, so you can descend after crossing ORIYE; if you don't have DME then you hold 1940 feet until the MAP: 0.6 DME from IWA.
- ❏ You have DME and KIWA's altimeter setting - to what altitude would you descend after crossing ORIYE? 1800 feet.
- ❏ What if you have DME but you don't have KIWA's altimeter setting, what is your MDA now? 1880 feet.

For additional practice, use a similar clearance for an approach starting at SLI for the ILS30 into KLGB:



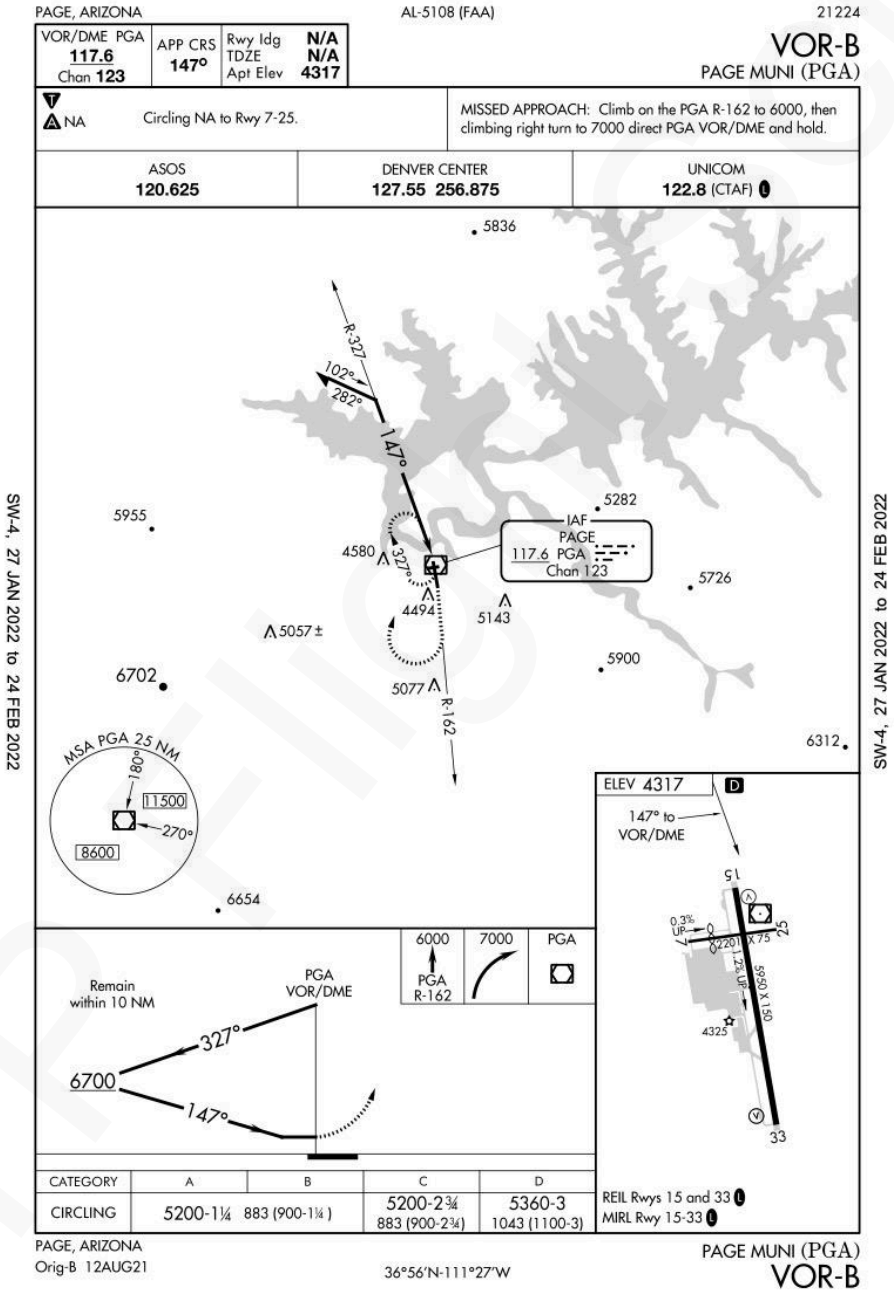


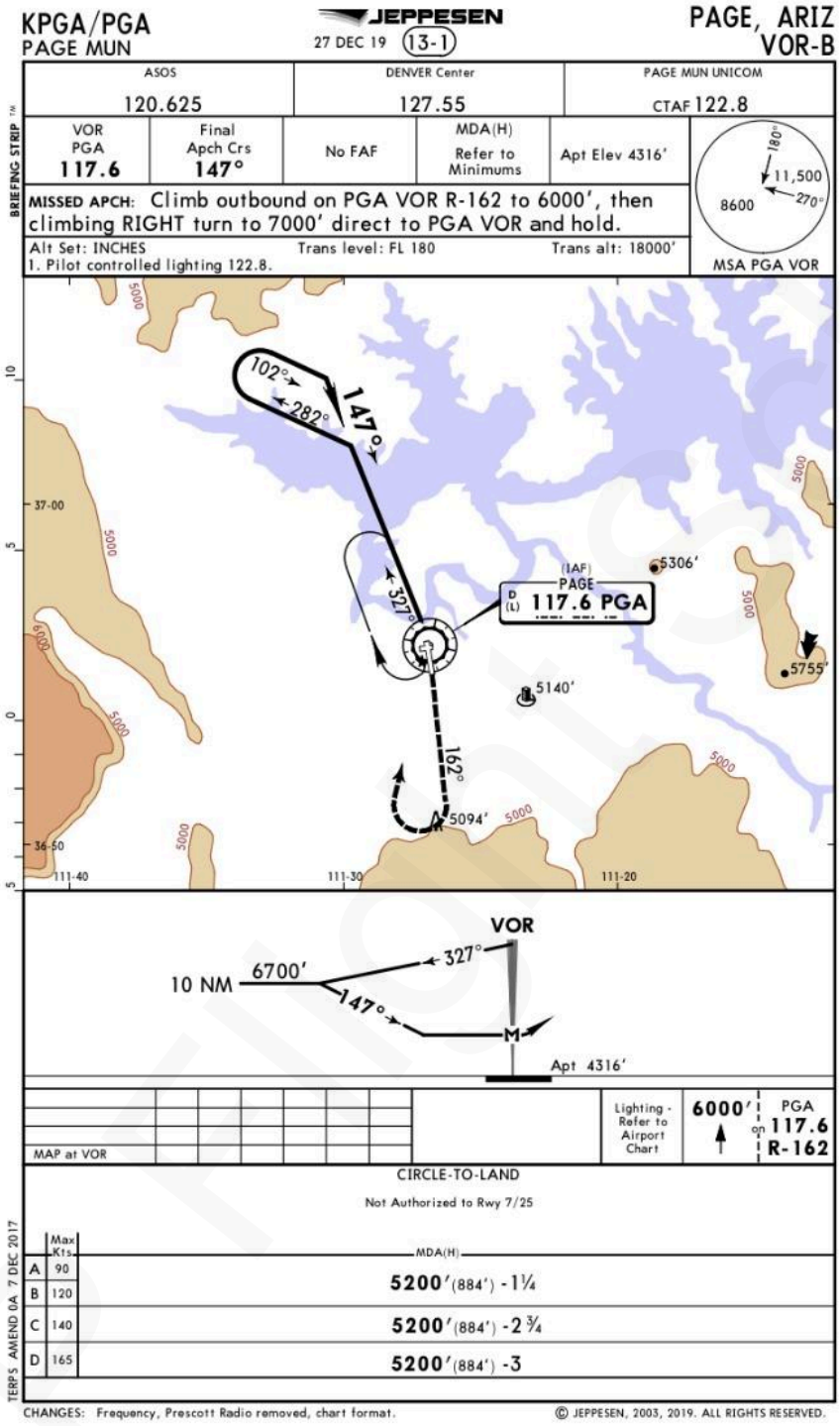
Additional nuances to address on the instrument approach procedure above:

- ❏ What does the black diamond symbol with the white letter “C” inside it next to the circling minimums indicate? Expanded circling minimums.

- ❏ How can you tell that Runway 30 has a displaced threshold? The connected ovals symbol crossing the runway threshold in the airport sketch. For Jeppesen, refer to the Airport Diagram - the runway approach end will have a white stripe marking the beginning of the displaced threshold.
- ❏ If you're landing at this airport at night, which lights represent the beginning of where you're permitted to touch down? Green line of lights called runway end/threshold lights.

For additional practice, try the VOR-B into KPGA starting at PGA:





The approach above is unique in that it's an on-field VOR approach and therefore does not have a depicted FAF/maltese cross. Because of this, some additional questions should include:

- ❏ What is your FAF on this approach? The equivalent would be: re-established inbound (following the procedure turn).

- ❏ When will you configure? Generally, when you are re-established inbound.
- ❏ Why are only circling minimums depicted for this approach? Either because the approach course is not aligned within 30 degrees of the runway, or because more than a 400 feet/nm descent is required on the final approach course. In this case, the latter. Put differently, circling will very likely be necessary.
- ❏ Why is there no runway specified in the title of this approach? Same as the answer to the previous question: either it's not a straight-in approach or the descent gradient exceeds 400 feet/nm.
- ❏ Do you *have* to circle to land on this approach (because only circling minimums are published), or is a straight-in landing permitted? Straight-in landing is permitted.

Icing (IR.I.C.S5 and IR.I.B.K3i)

The following is an example series of scenarios and questions that an instructor can use to test a student's icing knowledge:

- ❏ You're about to fly a new aircraft for the first time, how can you determine whether it's certified to fly into icing conditions? Section 2 (Limitations) of the POH. Sometimes this information is found in Section 3 (Emergency Procedures) as well.
- ❏ Is your aircraft (C172 or Archer) certified to fly into known icing conditions? No.
- ❏ What does the FAA consider to be known icing conditions? The AIM defines known icing as "atmospheric conditions in which the formation of ice is observed or detected in flight". However, an FAA letter of interpretation clarifies known icing to be: when a "reasonable and prudent" pilot would determine that, along the proposed route and altitude, the weather information indicates that ice would form on the plane.
  http://download.aopa.org/epilot/2009/090126icing.pdf
- ❏ At times the enroute temperature is expected to be around 5 degrees and it looks like you'll be flying through some clouds. What's something you would certainly need to check during your preflight that you typically wouldn't if you were just preflighting for a local practice flight on a clear day? Pitot heat.
- ❏ During your preflight you notice that there's a small amount of frost on top of the wing that hasn't melted yet. You're practically certain that by the time you're finished with your run-up that it will have melted. Would you start the plane up and proceed with your flight? No, terrible ADM, you'll have taken off without confirming that the plane is free of ice.
- ❏ You've just departed KIWA on Runway 30L. After departure you followed your IFR clearance which was to turn left heading 120 and climb and maintain 5000 feet MSL. You enter the clouds at 3000 feet MSL and immediately start picking up structural icing. Where would you expect this ice to form first?
- ❏ What are you going to do? Declare an emergency, turn on all of your anti-icing equipment (pitot heat, which should've been turned on well prior to entering the clouds in order to give it time to heat up), descend below the clouds, rejoin the VFR traffic pattern and land.

- ❏ After declaring an emergency, the tower tells you to continue your climb, that they need the airspace clear so that Allegiant can conduct a takeoff. What are you going to do? You've declared an emergency. Descend regardless of ATC instruction.
- ❏ Up at cruising altitude your OAT reads 4 degrees C. You see some stratiform clouds up ahead in about 5 miles, it looks like you'll be in them in a few minutes. What are you going to turn on? Turn on the pitot heat immediately, give it plenty of time to heat up.
- ❏ Is pitot heat intended to be anti or de-icing? Anti. What's the difference? The former is intended to prevent ice from forming, the latter removes ice that has already formed.
- ❏ You're enroute, it's raining, and the OAT reads -2 degrees C. What is a possible concern here? Freezing rain/supercooled water droplets.
- ❏ What kind of ice would form when the rain hits the aircraft? Clear or glaze ice.
- ❏ What is the most dangerous type of airframe icing? Why? Clear or glaze ice, because it's heavy and difficult to see, changes shape of the airfoil, disrupts lift characteristics, and spreads out over parts of the wing that are not equipped with anti/de-icing features.
- ❏ Further along on your flight the temperature rises to +2 degrees C and you re-enter the clouds. Is it still possible to pick up airframe icing even though the temp is above 0 degrees C? How? Yes, from aerodynamic cooling. Also, the exterior of the plane, due to wind chill, is generally colder than the ambient air temperature.
- ❏ On the arrival into your destination airport you're in IMC with the temperature around freezing. You find yourself having to add more and more nose-up trim in order to relieve control pressures. You extend flaps and suddenly the nose drops. What just happened? Tailplane stall.
  - ❏ How do you recover? Pitch up, reduce throttle, retract flaps, i.e. reduce negative lift on the tail.
- ❏ You're in the clouds descending into an airport and the OAT is approximately 0 degrees C. You notice your airspeed increasing as you descend, despite the fact that you haven't increased power or increased your rate of descent. What do you think the problem is? Blocked static port.
- ❏ What are you going to do? Use alternate static air.
- ❏ Where is this alternate static air being taken from? Inside the cabin.
- ❏ Is this alternate static air inside the cabin relatively lower or higher than the air pressure outside? Lower.
- ❏ What indications will you get on your pitot/static instruments when you use the alternate static air? Airspeed indicator and altimeter will read slightly higher. VSI will momentarily jump up a bit, then return to reading accurately.
- ❏ You've picked up some structural icing. What will you change about your approach to land, if anything? Increase approach speed, and don't extend the flaps.
- ❏ Generally, would you expect ice to accumulate more rapidly on the leading edge of the horizontal stabilizer or the leading edge of the wing? Explain. Stabilizer - it's the smaller, thinner surface.

Area of Operation II. Preflight Procedures

Task A. Aircraft Systems Related to Instrument Flight Rules (IFR) Operations

References: 14 CFR part 91; AC 91-74; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-25; POH/AFM

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with anti-icing or deicing systems, and other systems related to IFR flight.

Knowledge:	The applicant demonstrates understanding of:
IR.II.A.K1	The general operational characteristics and limitations of applicable anti-icing and deicing systems, including airframe, propeller, intake, fuel, and pitot-static systems.
IR.II.A.K2	Flight control systems.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.II.A.R1	Operations in icing conditions.
IR.II.A.R2	Limitations of anti-icing and deicing systems.
IR.II.A.R3	Use of automated systems in instrument conditions.
Skills:	The applicant exhibits the skill to:
IR.II.A.S1	Demonstrate familiarity with anti- or de-icing procedures or information published by the manufacturer specific to the aircraft used on the practical test.
IR.II.A.S2	Demonstrate familiarity with the automatic flight control system (AFCS) procedures or information published by the manufacturer specific to the aircraft used on the practical test, if applicable.

(This task was addressed almost entirely in the IR.I.C.S5 icing scenario in the Cross Country Flight Planning task.)

- ❏ During a climb in IMC with the temperature around 0 degrees C you notice the airspeed oddly increasing. What could be the cause of this? Ram air and drain holes are both iced over.
- ❏ Enroute you're in IMC with the temperature around 0 degrees C. Your KIAS gradually drops to 0 degrees C. Why did this happen? Ram hole is iced over, drain is open.
- ❏ How does the pitot heat work? There's a heating element (essentially a wire coil that partially resists electric current and the resistance leads to heat) inside the pitot tube that heats up when supplied with electricity. This heats up the metal pitot tube that surrounds it.

Task B. Aircraft Flight Instruments and Navigation Equipment

References: *14 CFR part 91; AC 90-100, AC 90-105, AC 90-107, AC 91-78, AC 91.21-1; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-25*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with managing instruments appropriate for an IFR flight.

Knowledge:	The applicant demonstrates understanding of:
IR.II.B.K1	Operation of the aircraft's applicable flight instrument system(s), including:
IR.II.B.K1a	a. Pitot-static instrument system and associated instruments
IR.II.B.K1b	b. Gyroscopic/electric/vacuum instrument system and associated instruments
IR.II.B.K1c	c. Electrical systems, electronic flight instrument displays [primary flight display (PFD), multi-function display (MFD)], transponder and automatic dependent surveillance - broadcast (ADS-B)
IR.II.B.K1d	d. Magnetic compass
IR.II.B.K2	Operation of the aircraft's applicable navigation system(s), including:
IR.II.B.K2a	a. Very high frequency (VHF) Omnidirectional Range (VOR), distance measuring equipment (DME), instrument landing system (ILS), marker beacon receiver/indicators

* Refer to the Commercial Study Guide for additional information about flight instrument systems.

- ❏ For each flight instrument and navigation instrument, students should be able to answer these questions:
  1. How does it work?
  2. What does each marking on the instrument mean?
  3. What are its limitations?
  4. How would you know if it were inoperative?

Below are some additional, more specific questions about the flight/navigation instruments that tend to confuse students:

- ❏ On the Attitude Indicator, is the gyro attached to the artificial horizon/ground-sky card or to the miniature airplane? The artificial horizon. Just like the actual horizon, the artificial horizon doesn't move and the plane rotates around it.
- ❏ What Attitude Indicator design feature keeps the gyro upright and prevents it from precessing? Pendulous veins.
- ❏ Does the VSI have an aneroid wafer or a diaphragm? Diaphragm.
  - ❏ Does it expand or contract during a climb? Contract.
- ❏ What do the crosshatches represent on an Altimeter? Below 10,000 feet.
- ❏ What is the difference between a Turn Coordinator (TC) and a Turn and Slip Indicator (TSI)? Turn Coordinator shows rate of roll then rate of turn; Turn and Slip Indicator shows only rate of turn.

- ❏ What enables the Turn Coordinator to show rate of roll? 30 degree canted gyro.
- ❏ You've lost your Attitude Indicator. You're in a standard rate turn to the left per the miniature airplane on your Turn Coordinator. You start leveling the wings with a roll to the right. What will your Turn Coordinator show you when the actual aircraft is wings level? It shows rate of roll first, so because you're rolling right, the miniature airplane will show approximately a standard rate turn to the right. At this point stop rolling right and the wings on the Turn Coordinator will level...because you're no longer rolling or turning.
- ❏ While establishing a forward slip to land on final, what will the needle and ball on a Turn and Slip Indicator show? The needle will continue to point straight up and down. The ball will show a slip.
- ❏ You're turning to the left and the ball falls to the inside, is this a slip or a skid? Slip.
- ❏ What are the definitions and causes of a slip and a skid? A slip is when you have too much bank for your rate of turn, causing the ball on the inclinometer and the tail of the aircraft to slip inward (in the direction of the bank). A slip is generally caused by adverse yaw and insufficient rudder in the direction of the turn. A skid occurs when your rate of turn is too great for the angle of bank, causing the ball (and the tail of the airplane) to swing to the outside. This is caused by too much rudder in the direction of the turn.

❏ Describe how the compass works as well as all of its errors.

- ❏ While on heading 360, you accelerate. What will the compass heading indicate? It will continue indicating north. The acceleration/deceleration errors only apply to east and west headings.
- ❏ You're southbound and you make a left turn with the goal of rolling out on a compass heading of 360. What will the compass read when you should roll wings level in order to roll out on the 360 heading? (Answer is location dependent)
  - ❏ What if you want to roll out on a heading of 060 instead? (Answer is location dependent).
- ❏ Where does the 30 degree under/overshoot correction for rolling out on 360/180 headings come from? Is it always 30 degrees? **The formula is 15 degrees plus half the latitude. So no, this number can vary depending on your latitude**.

❏ On conventional instruments, what indication on the HSI shows that you are not receiving a navigation signal? 'Nav' flag.

- ❏ What about on the G1000 HSI? Missing course deviation bar.

❏ What is the range of DME?

- ❏ How can you tell if there is DME co-located with a VOR?
- ❏ Can we get DME from a TACAN VOR?

❏ Where are a Mode C transponder and ADS-B/Out required?

❏ How is a marker beacon depicted on an approach plate?

- ❏ What are the types, their colors, sounds, and what does each represent along an approach?
- ❏ What is an LOM?
- ❏ How exactly will you be notified that you've crossed the OM if flying with 'glass instrumentation'?

- ❏ What are the components of an ILS? Guidance (LOC and GS), Range (DME, MBs, Time), and Visual (Lights)
  - ❏ Where are the localizer and glideslope ground equipment located on the field?
  - ❏ Where is the localizer and glideslope antenna on the aircraft?
  - ❏ How many times more sensitive is a localizer than a VOR?
  - ❏ You are full scale deflection on the localizer at the approach end of the runway. Approximately how far off course are you?
  - ❏ When on glideslope, by approximately how many feet AGL do you cross over the approach end of the runway?

Task C. Instrument Flight Deck Check

References: 14 CFR part 91; AC 91.21-1; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-25; POH/AFM

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with conducting a preflight check on the aircraft's instruments necessary for an IFR flight.

Knowledge:	The applicant demonstrates understanding of:
IR.II.C.K1	Purpose of performing an instrument flight deck check and how to detect possible defects.
IR.II.C.K2	IFR airworthiness, including aircraft inspection requirements and required equipment for IFR flight.
IR.II.C.K3	Required procedures, documentation, and limitations of flying with inoperative equipment.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.II.C.R1	Operating with inoperative equipment.
IR.II.C.R2	Operating with outdated navigation publications or databases.
Skills:	The applicant exhibits the skill to:
IR.II.C.S1	Perform preflight inspection by following the checklist appropriate to the aircraft and determine if the aircraft is in a condition for safe instrument flight.

<u>Inspection Requirements</u>

- ❏ What is the process for determining that an airplane is airworthy for an IFR flight?
- ❏ Which inspections are required only for IFR flights, not for VFR?
- ❏ What options are available for complying with the 30-day VOR check?
  - ❏ Other than the bench test, how exactly do you conduct each type of these VOR checks?
  - ❏ What should the centered CDI needle read on a VOT check? 360 from, 180 to.
  - ❏ Where do you look to determine whether an airport offers a VOT (or airborne or ground) check? Chart Supplement or Foreflight.
  - ❏ Can you do a dual VOR check in the air? Yes.
  - ❏ What is the maximum bearing discrepancy on a dual VOR check in the air? +-4 degrees.

- ❏ What information are you required to log after a dual VOR check?

Required Equipment

- ❏ List out all of the equipment required for an IFR flight at night. As you do so, describe how you can confirm that each item is operational.
- ❏ What equipment is required for an IFR flight during the day? ATOMATOFLAMES and GRABCARDD. But NOT FLAPS, which would only be required during a night flight, either VFR or IFR.
- ❏ Can the distance on your GPS substitute for the DME required at altitudes above FL240? Yes.
- ❏ Describe your after-start instrument check. What do you look for and why?

Inoperative Equipment (Without an MEL)

- ❏ Scenario #1: It's MVFR outside (4sm visibility). You're planning on a VFR flight out to the practice area to conduct practice approaches. You get in the plane and see that there's an "INOPERATIVE" sticker right under the alternate static knob. Take me through your process for determining whether you would proceed with the flight. Refer to 91.213(d)(2). Not required by: Part 91, TCDS, ADs, the Equipment List, or by the Kinds of Operations Equipment List (KOEL). In fact the KOEL specifies that the Alternate Static is not required for VFR flights. However...it is required for IFR. Because the weather is MARGINAL, there's a chance that you may have to pick up an IFR clearance on this flight, in which case you'd need an operating alternate static source. Even if the conditions never became IFR, flying around in marginal VFR without an alternate static would demonstrate poor ADM. It would be advisable to make a no-go decision.

- ❏ Scenario #2: This time you're flying on an IFR flight plan at night in VMC. After starting the engine, you turn the cockpit lights on and notice that the light is out on your standby Airspeed Indicator. Take me through your process for determining whether you would proceed with the flight. Go through the same process that is detailed in the answer to the previous scenario. On the KOEL, the internal lighting for the standby Airspeed Indicator is listed as required for IFR night operations. Make a no-go decision and 'squawk' the plane. This fix is not listed under Part 43 for preventative maintenance, so appropriately rated maintenance personnel must perform the maintenance and update the maintenance logs prior to an IFR night flight taking place.

Area of Operation III. Air Traffic Control (ATC) Clearances and Procedures

Task A. Compliance with Air Traffic Control Clearances

References: 14 CFR parts 91; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with ATC clearances and procedures while operating solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.III.A.K1	Elements and procedures related to ATC clearances and pilot/controller responsibilities for departure, en route, and arrival phases of flight, including clearance void times.
IR.III.A.K2	Pilot-in-Command (PIC) emergency authority.
IR.III.A.K3	Lost communication procedures and procedures for flights outside of radar environments.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.III.A.R1	Less than full understanding of an ATC clearance.
IR.III.A.R2	Inappropriate, incomplete, or incorrect ATC clearances.
IR.III.A.R3	ATC clearance inconsistent with aircraft performance or navigation capability.
IR.III.A.R4	ATC clearance intended for other aircraft with similar call signs.
Skills:	The applicant exhibits the skill to:
IR.III.A.S1	Correctly copy, read back, interpret, and comply with simulated or actual ATC clearances in a timely manner using standard phraseology as provided in the Aeronautical Information Manual (AIM).
IR.III.A.S2	Correctly set communication frequencies, navigation systems (identifying when appropriate), and transponder codes in compliance with the ATC clearance.
IR.III.A.S3	Use the current and appropriate paper or electronic navigation publications.
IR.III.A.S4	Intercept all courses, radials, and bearings appropriate to the procedure, route, or clearance in a timely manner.
IR.III.A.S5	Maintain the applicable airspeed ±10 knots, headings ±10°, altitude ±100 feet; track a course, radial, or bearing within ¾-scale deflection of the course deviation indicator (CDI).
IR.III.A.S6	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.
IR.III.A.S7	Perform the appropriate checklist items relative to the phase of flight.

(Knowledge and Risk Management elements addressed in other tasks. Lost communication procedures, IR.III.A.K3, are addressed later in the Loss of Communication task.)

Task B. Holding Procedures

References: 14 CFR part 91; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with holding procedures solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.III.B.K1	Elements related to holding procedures, including reporting criteria, appropriate speeds, and recommended entry procedures for standard, nonstandard, published, and non-published holding patterns.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.III.B.R1	Recalculating fuel reserves if assigned an unanticipated expect further clearance (EFC) time.
IR.III.B.R2	Scenarios and circumstances that could result in minimum fuel or the need to declare an emergency.
IR.III.B.R3	Scenarios that could lead to holding, including deteriorating weather at the planned destination.
IR.III.B.R4	Holding entry and wind correction while holding.

Skills:	The applicant exhibits the skill to:
IR.III.B.S1	Use an entry procedure appropriate for a standard, nonstandard, published, or non-published holding pattern.
IR.III.B.S2	Change to the holding airspeed appropriate for the altitude when 3 minutes or less from, but prior to arriving at, the holding fix and set appropriate power as needed for fuel conservation.
IR.III.B.S3	Recognize arrival at the holding fix and promptly initiate entry into the holding pattern.
IR.III.B.S3a	a. Comply with the holding pattern leg length and other restrictions, if applicable, associated with the holding pattern
IR.III.B.S4	Maintain airspeed ±10 knots, altitude ±100 feet, selected headings within ±10°, and track a selected course, radial, or bearing within ¾-scale deflection of the course deviation indicator (CDI).
IR.III.B.S5	Use proper wind correction procedures to maintain the desired pattern and to arrive over the fix as close as possible to a specified time.
IR.III.B.S6	Use a multi-function display (MFD) and other graphical navigation displays, if installed, to monitor position in relation to the desired flightpath during holding.
IR.III.B.S7	Comply with ATC reporting requirements and restrictions associated with the holding pattern.
IR.III.B.S8	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

- ❏ Draw the hold for the _____ ODP.
  - ❏ What hold entry will you use?
  - ❏ Simulate the call you would make to ATC as you cross the holding fix.
- ❏ You're told to hold at _____ thousand feet. What is your max airspeed?
  - ❏ How long will you fly the inbound leg?
- ❏ Draw this hold: "Hold over the VOR on the 180 radial, right turns."

- ❏ Let's say there's a crosswind from the left/west that forces you to fly heading 350 in order to maintain the 360 inbound track. What heading will you fly on the outbound leg? Triple the wind correction, so a 210 heading.
- ❏ What is the risk involved in not tripling the correction on the outbound leg? You could end up on the unprotected side of the hold, as the wind will push you toward that side during the turns.

❏ Draw this hold: *"Cessna 976SP, hold Southeast of the 10DME fix on the IWA 330 degree radial, left turns."*

- ❏ Are the left turns here standard or non-standard?

❏ After holding for a while, you're now running rather low on fuel. If you have to wait much longer you think you'll have to declare an emergency. Without declaring an emergency, what is something that you could declare to ATC that might help them to realize you're a priority and that they should work to get you on the ground without further delay? Declare "minimum fuel."

Area of Operation IV. Flight by Reference to Instruments

Task A. Instrument Flight

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing basic flight maneuvers solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.IV.A.K1	Elements related to attitude instrument flying during straight-and-level flight, climbs, turns, and descents while conducting various instrument flight procedures.
IR.IV.A.K2	Interpretation, operation, and limitations of pitch, bank, and power instruments.
IR.IV.A.K3	Normal and abnormal instrument indications and operations.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.IV.A.R1	Situations that can affect physiology and degrade instrument cross-check.
IR.IV.A.R2	Spatial disorientation and optical illusions.
IR.IV.A.R3	Flying unfamiliar aircraft or operating with unfamiliar flight display systems and avionics.
Skills:	The applicant exhibits the skill to:
IR.IV.A.S1	Maintain altitude ±100 feet during level flight, selected headings ±10°, airspeed ±10 knots, and bank angles ±5° during turns.
IR.IV.A.S2	Use proper instrument cross-check and interpretation, and apply the appropriate pitch, bank, power, and trim corrections when applicable.

(Many element(s) in this task were addressed earlier in the Airplane Flight Instruments and Navigation Equipment task.)

- ❏ Describe how you would use the primary/supporting technique during straight and level flight, climbs, turns, and descents.
- ❏ Describe how you would use the control and performance technique during straight and level flight, climbs, turns, and descents.
- ❏ You're enroute and ATC says, "Cessna 976SP, climb maintain one three thousand feet, expect lower in approximately 45 minutes upon crossing INW." What's your response? Something to the effect of: "Unable, we do not have supplemental oxygen."
- ❏ You're cleared for the visual approach while flying at night. While approaching the airport you accidentally fly into a cloud. First of all, what is the major instrument-flight principle you should keep in mind in order to prevent spatial disorientation? Trust your instruments.
  - ❏ Your aircraft's flashing lights start making you feel nauseous. What is this called and what are you going to do about it? Flicker vertigo. Turn off the strobes.
  - ❏ The runway you've been cleared for is upsloping and narrow. What illusion should you expect as you turn on to final? Expect to feel like you're higher than you actually are; pilots fly low approaches with narrower-than-usual and/or upsloping runways.
  - ❏ What should be done to prevent flying a lower-than-usual approach? Follow the VGSI.

Task B. Recovery from Unusual Flight Attitudes

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-25; POH/AFM

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with recovering from unusual flight attitudes solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.IV.B.K1	Procedures for recovery from unusual attitudes in flight.
IR.IV.B.K2	Prevention of unusual attitudes, including flight causal, physiological, and environmental factors, and system and equipment failures.
IR.IV.B.K3	Procedures available to safely regain visual meteorological conditions (VMC) after flight into inadvertent instrument meteorological conditions or unintended instrument meteorological conditions (IIMC)/(UIMC).
IR.IV.B.K4	Appropriate use of automation, if applicable.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:

IR.IV.B.R1	Situations that could lead to loss of control in-flight (LOC-I) or unusual attitudes in-flight (e.g., stress, task saturation, inadequate instrument scan distractions, and spatial disorientation).
IR.IV.B.R2	[Archived]
IR.IV.B.R3	Operating envelope considerations.
IR.IV.B.R4	Interpreting flight instruments.
IR.IV.B.R5	Assessment of the unusual attitude.
IR.IV.B.R6	Control input errors, inducing undesired aircraft attitudes.
IR.IV.B.R7	Control application solely by reference to instruments.
IR.IV.B.R8	Collision hazards.
IR.IV.B.R9	Distractions, task prioritization, loss of situational awareness, or disorientation.

Skills:	The applicant exhibits the skill to:
IR.IV.B.S1	Use proper instrument cross-check and interpretation to identify an unusual attitude (including both nose-high and nose-low) in flight, and apply the appropriate flight control, power input, and aircraft configuration in the correct sequence, to return to a stabilized level flight attitude.
IR.IV.B.S2	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

- ❏ Which instruments should you reference for unusual attitude recoveries? Turn Coordinator (the rate-of-turn indicator portion) and the Airspeed Indicator.
  - ❏ Why? They don't tumble, as opposed to the Heading Indicator and Attitude Indicator which can tumble. An inoperative Attitude Indicator, in particular, might be the reason you're in the unusual attitude in the first place.
  - ❏ Does this change in glass cockpits? If so, how? Yes, there are no spinning gyros that can tumble in a G1000, therefore the attitude indicator can be utilized.
- ❏ You're in IMC with turbulence and the stall horn sounds. You look at your turn coordinator and the miniature airplane is showing a turn to the right. What is your recovery procedure?
  - ❏ Why is reducing angle of attack paramount in this situation? To prevent a stall.
- ❏ Your vacuum system fails but you don't notice. So as your Attitude Indicator slowly starts to 'droop', and you follow it. Your airspeed is climbing and you look at your turn coordinator and it's showing a turn to the left. What is your recovery procedure?
  - ❏ Why is it important to level the wing before pitching up? To unload the aircraft first.

Area of Operation V. Navigation Systems

Task A. Intercepting and Tracking Navigational Systems and DME Arcs

References: 14 CFR part 91; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; POH/AFM

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with intercepting and tracking navigation aids and arcs solely by reference to instruments.

Note: *The evaluator should reference the manufacturer's equipment supplement(s) as necessary for appropriate limitations, procedures, etc.*

Note: *See Appendix 3: Aircraft, Equipment, and Operational Requirements & Limitations for information related to this Task.*

Knowledge:	The applicant demonstrates understanding of:
IR.V.A.K1	Ground-based navigation (orientation, course determination, equipment, tests, and regulations), including procedures for intercepting and tracking courses and arcs.
IR.V.A.K2	Satellite-based navigation (orientation, course determination, equipment, tests, regulations, interference, appropriate use of databases, Receiver Autonomous Integrity Monitoring (RAIM), and Wide Area Augmentation System (WAAS)), including procedures for intercepting and tracking courses and arcs.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.V.A.R1	Management of automated navigation and autoflight systems.
IR.V.A.R2	Distractions, task prioritization, loss of situational awareness, or disorientation.
IR.V.A.R3	Limitations of the navigation system in use.
Skills:	The applicant exhibits the skill to:
IR.V.A.S1	Tune and identify the navigation facility/program the navigation system and verify system accuracy as appropriate for the equipment installed in the aircraft.
IR.V.A.S2	Determine aircraft position relative to the navigational facility or waypoint.
IR.V.A.S3	Set and orient to the course to be intercepted.
IR.V.A.S4	Intercept the specified course at appropriate angle, inbound to or outbound from a navigational facility or waypoint.
IR.V.A.S5	Maintain airspeed ±10 knots, altitude ±100 feet, and selected headings ±5°.
IR.V.A.S6	Apply proper correction to maintain a course, allowing no more than ¾-scale deflection of the course deviation indicator (CDI). If a distance measuring equipment (DME) arc is selected, maintain that arc ±1 nautical mile.
IR.V.A.S7	Recognize navigational system or facility failure, and when required, report the failure to air traffic control (ATC).
IR.V.A.S8	Use a multi-function display (MFD) and other graphical navigation displays, if installed, to monitor position, track wind drift, and to maintain situational awareness.
IR.V.A.S9	At the discretion of the evaluator, use the autopilot to make appropriate course intercepts, if installed.
IR.V.A.S10	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

- ❏ Show the student a picture of either an HSI (Horizontal Situation Indicator) with the CDI (Course Deviation Indicator) deflected. Draw a VOR on the whiteboard. Hand a model plane to the student and tell them to place the plane in its position relative to the VOR per the indications on the instruments.
- ❏ ATC instructs, “Fly heading ____ to intercept the VOR ____ radial and track (inbound/outbound)”. How would you use the navigation instruments to accomplish this? How would this look on the board with the model plane?
- ❏ After crossing the VOR, ATC says, *“Cessna 976SP, track outbound on the VOR _____ radial, at 10 DME, arc (direction)bound.”* With the instruments, how would you fly this? How would this look on the board with the model plane?

Task B. Departure, En Route, and Arrival Operations

References: *14 CFR parts 91, 97; AC 90-100, AC 90-105, AC 91-74; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; POH/AFM*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with IFR departure, en route, and arrival operations solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.V.B.K1	Elements related to ATC routes, including departure procedures (DPs) and associated climb gradients; standard terminal arrival (STAR) procedures and associated constraints.
IR.V.B.K2	Pilot/controller responsibilities, communication procedures, and ATC services available to pilots.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.V.B.R1	ATC communications and compliance with published procedures.
IR.V.B.R2	Limitations of traffic avoidance equipment.
IR.V.B.R3	Responsibility to use "see and avoid" techniques when possible.
Skills:	The applicant exhibits the skill to:
IR.V.B.S1	Select, identify (as necessary) and use the appropriate communication and navigation facilities associated with the proposed flight.
IR.V.B.S2	Perform the appropriate checklist items relative to the phase of flight.
IR.V.B.S3	Use the current and appropriate paper or electronic navigation publications.
IR.V.B.S4	Establish two-way communications with the proper controlling agency, use proper phraseology, and comply in a timely manner with all ATC instructions and airspace restrictions.
IR.V.B.S5	Intercept all courses, radials, and bearings appropriate to the procedure, route, or clearance in a timely manner.
IR.V.B.S6	Comply with all applicable charted procedures.
IR.V.B.S7	Maintain airspeed ±10 knots, altitude ±100 feet, and selected headings ±10°, and apply proper correction to maintain a course allowing no more than ¾-scale deflection of the course deviation indicator (CDI).
IR.V.B.S8	Update/interpret weather in flight.
IR.V.B.S9	Use displays of digital weather and aeronautical information, as applicable to maintain situational awareness.
IR.V.B.S10	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

(Knowledge elements mostly addressed earlier in XC Flight Planning task due to IR.I.C.S4)

- ❏ You're on an IFR flight plan in VMC. ATC has given you a heading and altitude to fly. You see an aircraft that appears to be at the same altitude, heading in your direction. Whose ultimate responsibility is it to maintain separation from this aircraft, yours or ATC's? It is your responsibility. When meteorological conditions permit, regardless of type of flight plan

or whether or not under the control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles.

- ❏ When it comes to the ‘see and avoid’ principle, why is it more important to keep attention outside the airplane, scanning for traffic, as opposed to relying more heavily on TIS or ADS-B? These features won’t pick up aircraft that are not equipped with working transponders, or in the case of TIS, aircraft out of radar coverage. Also, attention should be outside for terrain avoidance.

Area of Operation VI. Instrument Approach Procedures

Task A. Non-precision Approach

References: 14 CFR part 91; AC 120-108; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; Terminal Procedures Publications

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing non-precision approach procedures solely by reference to instruments.

Note: *See Appendix 3: Aircraft, Equipment, and Operational Requirements & Limitations for information related to this Task.*

Knowledge:	The applicant demonstrates understanding of:
IR.VI.A.K1	Procedures and limitations associated with a non-precision approach, including the differences between Localizer Performance (LP) and Lateral Navigation (LNAV) approach guidance.
IR.VI.A.K2	Navigation system indications and annunciations expected during an area navigation (RNAV) approach.
IR.VI.A.K3	Ground-based and satellite-based navigation systems used for a non-precision approach.
IR.VI.A.K4	A stabilized approach, including energy management concepts.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VI.A.R1	Deviating from the assigned approach procedure.
IR.VI.A.R2	Selecting a navigation frequency.
IR.VI.A.R3	Management of automated navigation and autoflight systems.
IR.VI.A.R4	Aircraft configuration during an approach and missed approach.
IR.VI.A.R5	An unstable approach, including excessive descent rates.
IR.VI.A.R6	Deteriorating weather conditions on approach.
IR.VI.A.R7	Operating below the minimum descent altitude (MDA) without proper visual references.

Skills:	The applicant exhibits the skill to:
IR.VI.A.S1	Accomplish the non-precision instrument approaches selected by the evaluator.
IR.VI.A.S2	Establish two-way communications with air traffic control (ATC) appropriate for the phase of flight or approach segment, and use proper communication phraseology.
IR.VI.A.S3	Select, tune, identify, and confirm the operational status of navigation equipment to be used for the approach.
IR.VI.A.S4	Comply with all clearances issued by ATC or the evaluator.
IR.VI.A.S5	Recognize if any flight instrumentation is inaccurate or inoperative, and take appropriate action.
IR.VI.A.S6	Advise ATC or the evaluator if unable to comply with a clearance.
IR.VI.A.S7	Complete the appropriate checklist(s).

IR.VI.A.S8	Establish the appropriate aircraft configuration and airspeed considering meteorological and operating conditions.
IR.VI.A.S9	Maintain altitude ±100 feet, selected heading ±10°, airspeed ±10 knots, no more than ¾ scale CDI deflection, and accurately track radials, courses, or bearings, prior to beginning the final approach segment.
IR.VI.A.S10	Adjust the published MDA and visibility criteria for the aircraft approach category, as appropriate, for factors that include Notices of Air Missions (NOTAMs), inoperative aircraft or navigation equipment, or inoperative visual aids associated with the landing environment, etc.
IR.VI.A.S11	Establish a stabilized descent to the appropriate altitude.
IR.VI.A.S12	For the final approach segment, maintain no more than ¾ scale CDI deflection, airspeed ±10 knots, and altitude, if applicable, above MDA +100/-0 feet to the Visual Descent Point (VDP) or missed approach point (MAP).
IR.VI.A.S13	Assess if the required visual references are available, and either initiate the missed approach procedure or continue for landing.
IR.VI.A.S14	Use a multi-function display (MFD) and other graphical navigation displays, if installed, to monitor position, track wind drift, and to maintain situational awareness.
IR.VI.A.S15	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

- ❏ You're flying an RNAV/GPS approach. Describe all the annunciations, modes, and scaling that you can expect during the various phases of the approach.
- ❏ What needs to be loaded at the end of your flight plan for all that sequencing and scaling you just described to occur? An approach.
- ❏ Some approach plates list multiple types of minimums, e.g. LP, LPV, LNAV, LNAV/VNAV. How will you know what minimums you can descend to? The approach mode annunciator on the GPS unit will notify you of which minimums you may use.
- ❏ As you approach the FAF, RAIM integrity becomes compromised. What signifies this to the pilot in a G1000 equipped aircraft? "LOI" will appear on the HSI, meaning GPS integrity is insufficient. You could also get a "RAIM not available between FAF and MAP" message.
  - ❏ What indication would you get in a G430 equipped aircraft? A yellow "INTEG" warning.
  - ❏ If you get one of these indications/messages before the FAF, what will you do? Don't descend, just continue tracking the approach laterally and go missed at the MAWP (missed approach waypoint).
  - ❏ What about after the FAF? Same procedure, i.e. stop descending, continue tracking the approach, go missed at the MAWP.
- ❏ Let's say "LP" is seen on the HSI as you approach the FAF. How will you expect the scaling on final to be different from if "LNAV' were showing? The scaling on an "LP" approach becomes more and more precise and sensitive as the airplane approaches the runway (aka angular scaling), i.e. it acts like a localizer. LNAV, on the other hand, maintains a .3 lateral scaling on final all the way to the MAP (aka linear scaling).
- ❏ What if, after you cross the FAF, ATC informs you that the ceiling is now '001 BKN' with 1/4sm visibility. Can you legally continue the approach? Under part 91, yes.
  - ❏ Would you? Why or why not?

❏ What should you do to the CDI needle when you're flying a localizer back course? Why?
Fly the tail of the needle in order to prevent reverse sensing.

Task B. Precision Approach

References: *14 CFR part 91; AC 90-105, AC 90-107; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; Terminal Procedures Publications*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing precision approach procedures solely by reference to instruments.

Note: *See Appendix 3: Aircraft, Equipment, and Operational Requirements & Limitations for information related to this Task.*

Knowledge:	The applicant demonstrates understanding of:
IR.VI.B.K1	Procedures and limitations associated with a precision approach, including determining required descent rates and adjusting minimums in the case of inoperative equipment.
IR.VI.B.K2	Navigation system displays, annunciations, and modes of operation.
IR.VI.B.K3	Ground-based and satellite-based navigation systems (orientation, course determination, equipment, tests and regulations, interference, appropriate use of navigation data, signal integrity).
IR.VI.B.K4	A stabilized approach, including energy management concepts.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VI.B.R1	Deviating from the assigned approach procedure.
IR.VI.B.R2	Selecting a navigation frequency.
IR.VI.B.R3	Management of automated navigation and autoflight systems.
IR.VI.B.R4	Aircraft configuration during an approach and missed approach.
IR.VI.B.R5	An unstable approach, including excessive descent rates.

IR.VI.B.R6	Deteriorating weather conditions on approach.
IR.VI.B.R7	Continuing to descend below the Decision Altitude (DA)/Decision Height (DH) when the required visual references are not visible.

Skills:	The applicant exhibits the skill to:
IR.VI.B.S1	Accomplish the precision instrument approach(es) selected by the evaluator.
IR.VI.B.S2	Establish two-way communications with air traffic control (ATC) appropriate for the phase of flight or approach segment, and use proper communication phraseology.
IR.VI.B.S3	Select, tune, identify, and confirm the operational status of navigation equipment to be used for the approach.
IR.VI.B.S4	Comply with all clearances issued by ATC or the evaluator.
IR.VI.B.S5	Recognize if any flight instrumentation is inaccurate or inoperative, and take appropriate action.
IR.VI.B.S6	Advise ATC or the evaluator if unable to comply with a clearance.
IR.VI.B.S7	Complete the appropriate checklist(s).
IR.VI.B.S8	Establish the appropriate aircraft configuration and airspeed considering meteorological and operating conditions.
IR.VI.B.S9	Maintain altitude ±100 feet, selected heading ±10°, airspeed ±10 knots, no more than ¾ scale CDI deflection, and accurately track radials, courses, or bearings, prior to beginning the final approach segment.
IR.VI.B.S10	Adjust the published DA/DH and visibility criteria for the aircraft approach category, as appropriate, to account for NOTAMS, inoperative aircraft or navigation equipment, or inoperative visual aids associated with the landing environment.
IR.VI.B.S11	Establish a predetermined rate of descent at the point where vertical guidance begins, which approximates that required for the aircraft to follow the vertical guidance.
IR.VI.B.S12	Maintain a stabilized final approach from the final approach fix (FAF) to DA/DH allowing no more than ¾-scale deflection of either the vertical or lateral guidance indications, and maintain the desired airspeed ±10 knots.
IR.VI.B.S13	Immediately initiate the missed approach procedure when at the DA/DH, and the required visual references for the runway are not unmistakably visible and identifiable.
IR.VI.B.S14	Transition to a normal landing approach (missed approach for seaplanes) only when the airplane is in a position from which a descent to a landing on the runway can be made at a normal rate of descent using normal maneuvering.
IR.VI.B.S15	Maintain a stabilized visual flight path from the DA/DH to the runway aiming point where a normal landing may be accomplished within the touchdown zone.
IR.VI.B.S16	Use a multi-function display (MFD) and other graphical navigation displays, if installed, to monitor position, track wind drift, and to maintain situational awareness.
IR.VI.B.S17	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

(Knowledge and risk management elements addressed earlier in the XC Flight Planning task.)

Task C. Missed Approach

References: 14 CFR parts 91, 97; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; Terminal Procedures Publications

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing a missed approach procedure solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.VI.C.K1	Elements related to missed approach procedures and limitations associated with standard instrument approaches, including while using a flight management system (FMS) or autopilot, if equipped.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VI.C.R1	Deviations from prescribed procedures or ATC instructions.
IR.VI.C.R2	Holding, diverting, or electing to fly the approach again.
IR.VI.C.R3	Aircraft configuration during an approach and missed approach.
IR.VI.C.R4	Factors that might lead to executing a missed approach procedure before the MAP or to a go-around below DA, DH, or MDA, as applicable.
IR.VI.C.R5	Management of automated navigation and autoflight systems.
Skills:	The applicant exhibits the skill to:
IR.VI.C.S1	Promptly initiate the missed approach procedure and report it to ATC.
IR.VI.C.S2	Apply the appropriate power setting for the flight condition and establish a pitch attitude necessary to obtain the desired performance.
IR.VI.C.S3	Configure the airplane in accordance with airplane manufacturer's instructions, establish a positive rate of climb, and accelerate to the appropriate airspeed, ±10 knots.
IR.VI.C.S4	Follow the recommended checklist items appropriate to the missed approach/go-around procedure.
IR.VI.C.S5	Comply with the published or alternate missed approach procedure.
IR.VI.C.S6	Advise ATC or the evaluator if unable to comply with a clearance, restriction, or climb gradient.
IR.VI.C.S7	Maintain the recommended airspeed ±10 knots; heading, course, or bearing ±10°; and altitude(s) ±100 feet during the missed approach procedure.
IR.VI.C.S8	Use an MFD and other graphical navigation displays, if installed, to monitor position and track to help navigate the missed approach.
IR.VI.C.S9	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.
IR.VI.C.S10	Request ATC clearance to attempt another approach, proceed to the alternate airport, holding fix, or other clearance limit, as appropriate, or as directed by the evaluator.

(Knowledge and risk management elements largely addressed earlier in the XC Flight Planning task.)

- ❏ Unless specified otherwise, what climb gradient ensures obstacle clearance on a missed approach? 200 ft/nm.

- ❏ When you are flying level at the MDA, you cross the VDP without the runway in sight. Do you execute a missed approach procedure or continue flying level at MDA until crossing the MAP? Why? Best procedure is to fly the MDA until the MAP. If you get the runway environment in sight after the VDP but before the MAP, you retain the option to circle to land, either straight in or opposite direction depending on wind direction. When you're flying slower aircraft, it's still feasible that you could make a straight in approach and landing using normal maneuvers after crossing the VDP. Technically, however, the only requirement here is that you don't TURN (provided the missed approach procedure involves an initial turn) until crossing the MAP; initiating the missed approach CLIMB prior to the MAP is permitted.
- ❏ On an RNAV/GPS approach when you cross the MAP, will the GPS unit sequence automatically to the missed approach segment, or do you as the pilot have to do something manually to trigger the GPS unit to sequence properly?
  - ❏ What happens if you don't do this?
- ❏ Unless stated otherwise, what minimum climb gradient is required on a missed approach? 200 feet/nm.
- ❏ You've executed the missed approach procedure after not being able to get the runway in sight. You call up ATC to report having executed the missed approach procedure and they ask you what your intentions are. What are your request options here?
- ❏ On an approach, you break out of the clouds around 1,500 feet AGL with the runway clearly in sight. During the landing roundout a gust of wind knocks you off centerline causing you to reject the landing. What are you going to do? No need to execute a missed approach procedure here, you still have the runway in sight. This is a simple go around. Just climb to TPA (traffic pattern altitude), cancel IFR, join the pattern, and land.

Task D. Circling Approach

References: *14 CFR parts 91, 97; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; Terminal Procedures Publications*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing a circling approach procedure.

Knowledge: The applicant demonstrates understanding of:

IR.VI.D.K1	Elements related to circling approach procedures and limitations, including approach categories and related airspeed restrictions.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VI.D.R1	Prescribed circling approach procedures.
IR.VI.D.R2	Executing a circling approach at night or with marginal visibility.
IR.VI.D.R3	Losing visual contact with an identifiable part of the airport.
IR.VI.D.R4	Management of automated navigation and autoflight systems.
IR.VI.D.R5	Management of altitude, airspeed, or distance while circling.
IR.VI.D.R6	Low altitude maneuvering, including stall, spin, or controlled flight into terrain (CFIT).
IR.VI.D.R7	Executing a missed approach after the MAP while circling.

Skills:	The applicant exhibits the skill to:
IR.VI.D.S1	Comply with the circling approach procedure considering turbulence, windshear, and the maneuvering capability and approach category of the aircraft.
IR.VI.D.S2	Confirm the direction of traffic and adhere to all restrictions and instructions issued by ATC or the evaluator.
IR.VI.D.S3	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.
IR.VI.D.S4	Establish the approach and landing configuration. Maintain a stabilized approach and a descent rate that ensures arrival at the MDA, or the preselected circling altitude above the MDA, prior to the missed approach point.
IR.VI.D.S5	Maintain airspeed ±10 knots, desired heading/track ±10°, and altitude +100/-0 feet until descending below the MDA or the preselected circling altitude above the MDA.
IR.VI.D.S6	Visually maneuver to a base or downwind leg appropriate for the landing runway and environmental conditions.
IR.VI.D.S7	If a missed approach occurs, turn in the appropriate direction using the correct procedure and appropriately configure the airplane.
IR.VI.D.S8	If landing, initiate a stabilized descent. Touch down on the first one-third of the selected runway without excessive maneuvering, without exceeding the normal operating limits of the airplane, and without exceeding 30° of bank.

(Knowledge and risk management elements largely addressed earlier in the XC Flight Planning task.)

- ❏ Which approach category does this aircraft fall under, and what determines it?
- ❏ List the protected radii for all the approach categories?
- ❏ What exactly does it mean to have a 1.3 nm protected circling radius? I.e. radius around what?
- ❏ Let's say you have a tail wind during your descent and your groundspeed is 105 knots but your indicated airspeed remains at 80 KIAS, which category would you use?

- ❏ At what point in the traffic pattern do you typically leave your circling minimums in order to start your descent to land? On base or final.
- ❏ Is there a way to circle to land straight-in? If so, how?
  - ❏ When might you use this?
- ❏ You are flying a right downwind too tight out of fear of losing sight of the runway. This shortens your base dramatically, ultimately causing you to overshoot final. In an attempt at expediting your right base-to-final turn, you start putting in more and more right rudder (in the direction of your turn) which causes a decrease in pitch. You correct by pitching back and using left aileron… why is this situation critical, what could this scenario lead to? A cross-controlled stall, then into a spin. Given the low altitude, there would be minimal room to recover.
  - ❏ Which direction would the aircraft spin? The plane will spin in the direction of the yaw/rudder application; to the right.
  - ❏ How would you attempt to recover from this spin?

Task E. Landing from an Instrument Approach

References: *14 CFR parts 91; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; POH/AFM*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing procedures for a landing from an instrument approach.

Note: *For non-amphibious seaplanes, this task applies only when the applicant has immediate access to an instrument approach to a waterway.*

Knowledge: The applicant demonstrates understanding of:

IR.VI.E.K1	Elements related to the pilot's responsibilities, and the environmental, operational, and meteorological factors that affect landing from a straight-in or circling approach.
IR.VI.E.K2	Airport signs, markings, and lighting, including approach lighting systems.
IR.VI.E.K3	Appropriate landing profiles and aircraft configurations.

Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VI.E.R1	Attempting to land from an unstable approach.
IR.VI.E.R2	Flying below the glidepath.
IR.VI.E.R3	Transitioning from instrument to visual references for landing.
IR.VI.E.R4	Aircraft configuration for landing.

Skills:	The applicant exhibits the skill to:
IR.VI.E.S1	Transition at the DA/DH, MDA, or visual descent point (VDP) to a visual flight condition, allowing for safe visual maneuvering and a normal landing.
IR.VI.E.S2	Adhere to all ATC or evaluator advisories, such as NOTAMs, windshear, wake turbulence, runway surface, and other operational considerations.
IR.VI.E.S3	Complete the appropriate checklist(s).
IR.VI.E.S4	Maintain positive airplane control throughout the landing maneuver.
IR.VI.E.S5	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

- ❏ You break off the VOR RUNWAY 5 approach in order to circle right traffic runway 23. Wind is reported to be 320 @ 15. How will this wind affect the way you fly your circle-to-land pattern, your final approach, the landing, and the roll out.
- ❏ While circling at night, you see blue lights on the ground. What do these represent?
- ❏ Within how many degrees of runway centerline and how far out from the runway threshold do VASIs and PAPIs provide obstacle clearance? Within 10 degrees either side of centerline for both, 4 nm out for VASI, 4 sm for the PAPI.
- ❏ You touch down on the runway at night and the tower informs you to roll out to the end of the runway and exit onto taxiway ___. Describe the edge lights and centerline lights that you will see as you taxi down the runway.
- ❏ Question the student on the signs and markings they will pass while taxiing to park.

Area of Operation VII. Emergency Operations

Task A. Loss of Communications

References: 14 CFR part 91; AIM; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with loss of communications while operating solely by reference to instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.VII.A.K1	Procedures to follow in the event of lost communication during various phases of flight, including techniques for reestablishing communications, when it is acceptable to deviate from an instrument flight rules (IFR) clearance, and when to begin an approach at the destination.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VII.A.R1	Possible reasons for loss of communication.
IR.VII.A.R2	Deviation from procedures for lost communications.
Skills:	The applicant exhibits the skill to:
IR.VII.A.S1	Recognize a simulated loss of communication.
IR.VII.A.S2	Simulate actions to re-establish communication.
IR.VII.A.S3	Determine whether to continue to flight plan destination or deviate.
IR.VII.A.S4	Determine appropriate time to begin an approach.
IR.VII.A.S5	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

<u>Lost Communications</u>

The following is your clearance to KABQ, be ready to copy: *"Cessna 976SP, cleared to Albuquerque International Airport via, PHX ONE DEPARTURE, V95, INW, V12, ABQ, climb maintain 5000, expect 11,000 in 10 minutes, Phoenix Departure frequency 124.9, squawk 4141."*

- ❏ Practice reading this clearance back to ATC.
- ❏ After departing IFR on Runway 30L, you immediately fly into IMC and lose communications. What are you going to do? Describe your lost communications process. Be sure to include route and altitudes for every segment of the flight. First, troubleshoot (provide examples). Second, squawk 7600. Third, continue flying your assigned route (at this point the ODP) and fly the highest of your minimum IFR altitude (you're not off-route, so in this case it's the 4,000 feet listed on the ODP), your expected altitude (but only if the time has elapsed, which in this case it has not), and your assigned altitude (5,000 feet). So climb to 5,000 feet until 10 minutes have passed, then climb to 11,000 feet. Maintain 11,000 feet for the remainder of the route, as this is the highest of the minimum IFR/expected/assigned altitudes for every segment.

Different note: If you'd lost communications after having been vectored off of the departure procedure, then you are off route, so your minimum IFR altitude becomes the OROCA during departure and enroute phases of flight, or, the MSA (minimum sector altitude) once inbound on an approach and within the MSA's range. Then, adjust the altitude upward so that it conforms with the IFR hemispheric rule. In terms of the route, if you lose communications after having been vectored off-route, proceed 'direct' to the fix or airway that you are being vectored to join.

- ❏ You're still in a lost communications scenario, in IMC, when you get to the end of your route (ABQ VOR). How will you descend from your enroute altitude and land the plane? (*IFR lost communication procedures can be as much of a gray area as anything in aviation. FSDOs, examiners, instructors . . . they often have different interpretations and expectations when it comes to 91.185, and in particular, procedures surrounding how and when to descend and land at the destination airport. The key here is to abide by the regulations when they are clear, to have a plan that will get the plane safely on the ground, and to demonstrate good ADM throughout. 3 valid options)*

1) The Literal Interpretation of the FARs Option.

Here's what 91.185 says about leaving the *clearance limit*, defined in the glossary as "the fix, point, or location to which an aircraft is cleared when receiving an ATC clearance" (therefore our clearance limit would be KABQ): "(ii) If the clearance limit is not a fix from which an approach begins (like KABQ, in our case), leave the clearance limit at the expect-further-clearance time if one has been received (one hasn't, in this case), **or if none has been received (we don't have an EFC, so this next part applies to us), upon arrival over the clearance limit (KABQ), and proceed to a fix from which an approach begins (an IAF) 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 (time off the ground + filed ETE).** How would this play out in reality? After arriving at ABQ VOR, you would have to use the GPS to navigate off-route over the airport (abide by the MSA), then upon crossing over the top of KABQ, head to an IAF (say, BIBQU for the RNAV3 if you expect the winds to favor runway 3; or head to JILUG for the RNAV8 if winds favor runway 8), preferably use IAFs with holds so that you have the option to hold if you arrive early, then start your descent at your ETA.

2) The SDL FSDO Option Circa 2016.

During an examiner meeting at the FSDO a few years ago, the lack of consistency surrounding 91.185 procedures on checkrides was raised. It was determined that applicants should end their IFR XC routes at an IAF, hold at that fix in the event that they arrive prior to the ETA, then descend along the approach at the ETA. This matches up with the FARs perfectly if "clearance limit" were instead defined as being the final fix along the assigned route (which very well could've been the FAA's intention when they wrote 91.185).

3) The Emergency Option

Being in a lost communications scenario in IMC while descending into an airport environment could certainly be considered an emergency. 6-4-1 in the AIM states the following: “It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure, when confronted by a situation not covered in the regulations, pilots are expected to exercise good judgment in whatever action they elect to take. Should the situation dictate, they should not be reluctant to use the emergency action contained in 14 CFR Section 91.3(b).” This option would have the pilot squawk 7700 and do what they need to do to get the plane safely on the ground (while utilizing good ADM, of course).

- ❏ At what time are you trying to get to an IAF? Your ETA
- ❏ How did you calculate your ETA? Time off the ground + filed ETE
- ❏ What will you do if you arrive at the fix early? Hold until your ETA (unless, perhaps, you’ve chosen The Emergency Option). It is good practice to elect to end your route at a fix with a published hold associated with it.
- ❏ Imagine that you are on the departure leg and you lose communications; so you decide to troubleshoot, squawk 7600, etc. To what altitude do you climb? What route do you fly? Fly 500 feet above the highest traffic pattern altitude, join the traffic pattern, and look for light gun signals.
- ❏ How can you tell if you have a stuck microphone? “TX” appears permanently next to the frequencies.
- ❏ What would you do if you had a stuck mic while climbing out of an airfield in VMC on an IFR flight plan? Try to fix it first. Then announce to ATC that you have a stuck microphone and that you’d like to turn around, join the pattern, and land. Switch off frequency (123.45 is a valid option) so that you’re not clogging up the radios. Look for light gun signals. You can switch back to tower frequency periodically in order to acknowledge the signals or to announce intentions.

(Area of Operation VII Tasks B and C are omitted from this study guide. They apply to multi-engine airplanes only.)

Task D. Approach with Loss of Primary Flight Instrument Indicators

References: *14 CFR part 91; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-15, FAA-H-8083-16, FAA-H-8083-25; POH/AFM; Terminal Procedures Publications*

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing an approach solely by reference to instruments with the loss of primary flight control instruments.

Knowledge:	The applicant demonstrates understanding of:
IR.VII.D.K1	Recognizing if primary flight instruments are inaccurate or inoperative, and advising ATC or the evaluator.
IR.VII.D.K2	Possible failure modes of primary instruments and how to correct or minimize the effect of the loss.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VII.D.R1	Use of secondary flight displays when primary displays have failed.
IR.VII.D.R2	Maintaining aircraft control.
IR.VII.D.R3	Distractions, task prioritization, loss of situational awareness, or disorientation.
Skills:	The applicant exhibits the skill to:
IR.VII.D.S1	Advise ATC or the evaluator if unable to comply with a clearance.
IR.VII.D.S2	Complete a non-precision instrument approach without the use of the primary flight instruments using the skill elements of the non-precision approach Task (see Area of Operation VI, Task A).
IR.VII.D.S3	Use single-pilot resource management (SRM) or crew resource management (CRM), as appropriate.

(Knowledge and Risk Management elements largely addressed earlier in the "Airplane Flight Instruments and Navigation Equipment" task.)

- ❏ Your AHRS just failed. Which instruments will this affect, and what indications/notifications will you receive? The Attitude Indicator, Rate-of-Turn indicator, Slip-Skid Indicator, and Heading Indicator will all fail. A large red "X" will appear over the Attitude Indicator along with the words "ATTITUDE FAIL" in yellow letters. A red "X" will also appear over the HDG.
  - ❏ Can you still fly precision approaches? Yes. Glideslope and localizer will still function properly. Use standby instruments along with the GPS course on the MFD and compass for heading.
  - ❏ Can you still fly non precision approaches? Yes.
  - ❏ Will you have a heading indication on your HSI? If not, how will you know your heading? No, this fails if the AHRS or magnetometer fails. Use the GPS course, GPS moving map, and the compass for heading info.
- ❏ Your ADC just failed. Which instruments will this affect, and what indications/notifications will you receive. The Airspeed Indicator, Altimeter, VSI, TAS, and OAT will fail. They will all display a red "X".
  - ❏ Can you still fly precision approaches? Yes. Use standby instruments.

- ❏ Can you still fly non precision approaches? Yes. Use standby instruments.
- ❏ Are you still capable of mode C transmission? If not, what mode is the aircraft capable of? Why is this important to recognize? No, you are now mode A. This means you can no longer operate in areas that require a mode C transponder without permission, so your flight plan should be adjusted accordingly.

❏ If the ram air hole and/or static port on a G1000 equipped aircraft becomes blocked, will you see red "X"s over the affected instruments? Or will the pitot/static instruments function abnormally like they do with pitot/static blockages in conventional aircraft? No red "X"; the instruments will behave like they do after blockages in conventional aircraft. The "X"s only appear after the equipment itself malfunctions or breaks.

❏ You've just been cleared for the ILS approach into KCGZ and the AHRS fails as you approach TFD. You're on an IFR flight plan in IMC. Is this a required call? Yes.

- ❏ Simulate this equipment malfunction report to ATC.

Area of Operation VIII. Postflight Procedures

Task A. Checking Instruments and Equipment

References: 14 CFR part 91; FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-25; POH/AFM

Objective: To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with checking flight instruments and equipment during postflight.

Knowledge:	The applicant demonstrates understanding of:
IR.VIII.A.K1	Procedures for documenting in-flight/postflight discrepancies.
Risk Management:	The applicant is able to identify, assess, and mitigate risk associated with:
IR.VIII.A.R1	Performance and documentation of postflight inspection and aircraft discrepancies.
Skills:	The applicant exhibits the skill to:
IR.VIII.A.S1	Conduct a postflight inspection and document discrepancies and servicing requirements, if any.

** Note: If any mx issues occur during the flight, applicants need to be sure to squawk the plane upon return from the flight. This is still part of the practical test/EOC.*

- ❏ Why is it important to conduct a thorough post-flight inspection?
- ❏ Describe what you look for during your post-flight inspection?
- ❏ Why is it important to placard inoperative equipment as 'INOPERATIVE' and document discrepancies?

Appendix 6: Safety of Flight

Stall and Spin Awareness. *(Addressed in the Circling Approach task.)*

Use of Checklists. *(Demonstrated in flight.)*

Use of Distractions. *(Demonstrated primarily in flight.)*

- ❏ Ask the student for the flight times while taxiing back to the ramp. Students should respond along the lines of, “sterile cockpit.”
- ❏ During taxi, ask the student to show you EXACTLY where the aircraft is on the taxiway diagram.

Positive Exchange of Flight Controls. *(Demonstrated in flight.)*

ADM, Risk Management, CRM and SRM. *(Demonstrated largely in flight.)*

- ❏ Define ADM, Risk Management, CRM, and SRM.
- ❏ What are some models a pilot can use by way of practicing good ADM?
- ❏ Explain the 5P, 3P, DECIDE, IMSAFE, and PAVE models/checklists. In particular, explain how each can be utilized in a way that contributes to good ADM.
- ❏ The door just opened after takeoff. Use the DECIDE model to address this situation. Alternate scenario: Enroute you start picking up trace amounts of rime ice on the leading edge of the wing. Use the DECIDE model to address this situation.
- ❏ What are the hazardous attitudes? Provide an aviation related example of each.

Written Exams

Applicants should learn everything they can about the subjects corresponding to each deficient element listed on the knowledge test report. These elements must be included in the evaluator’s Plan of Action and are certain to be areas of emphasis on the practical test.