

Night Operations

This presentation was prepared by the
New Mexico Wing, Civil Air Patrol
January, 2005

October, 1994



Statistics

- Night is 5 x more dangerous than day flying
- Night accidents are more likely to be fatal
 - 28% of fatal GA accidents occur at night
- Landings are 3 x more hazardous than takeoffs
- Most night accidents occur during DARK nights
- Recent night experience helps prevent accidents
- Does an instrument rating help? [26% non IFR]
- CFIT, plus VFR into IMC, = 60%

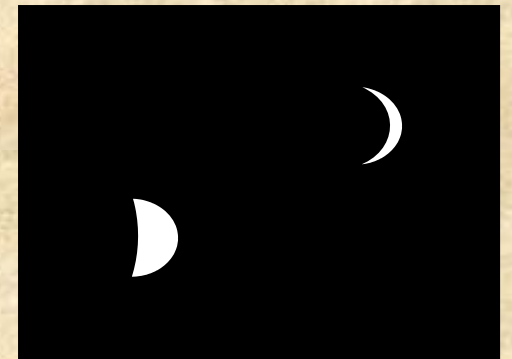
Risk factors

- Night = Day risk x 5
- Landing = takeoff risk: x 3
- Dark night: ?
- No recent night flying: ?
- Non IFR rated: ?

- 1. Night flying has more risks because you can't see well.*
- 2. You can't see well because there's less light.*

Moonlight: Night vs. DARK Night

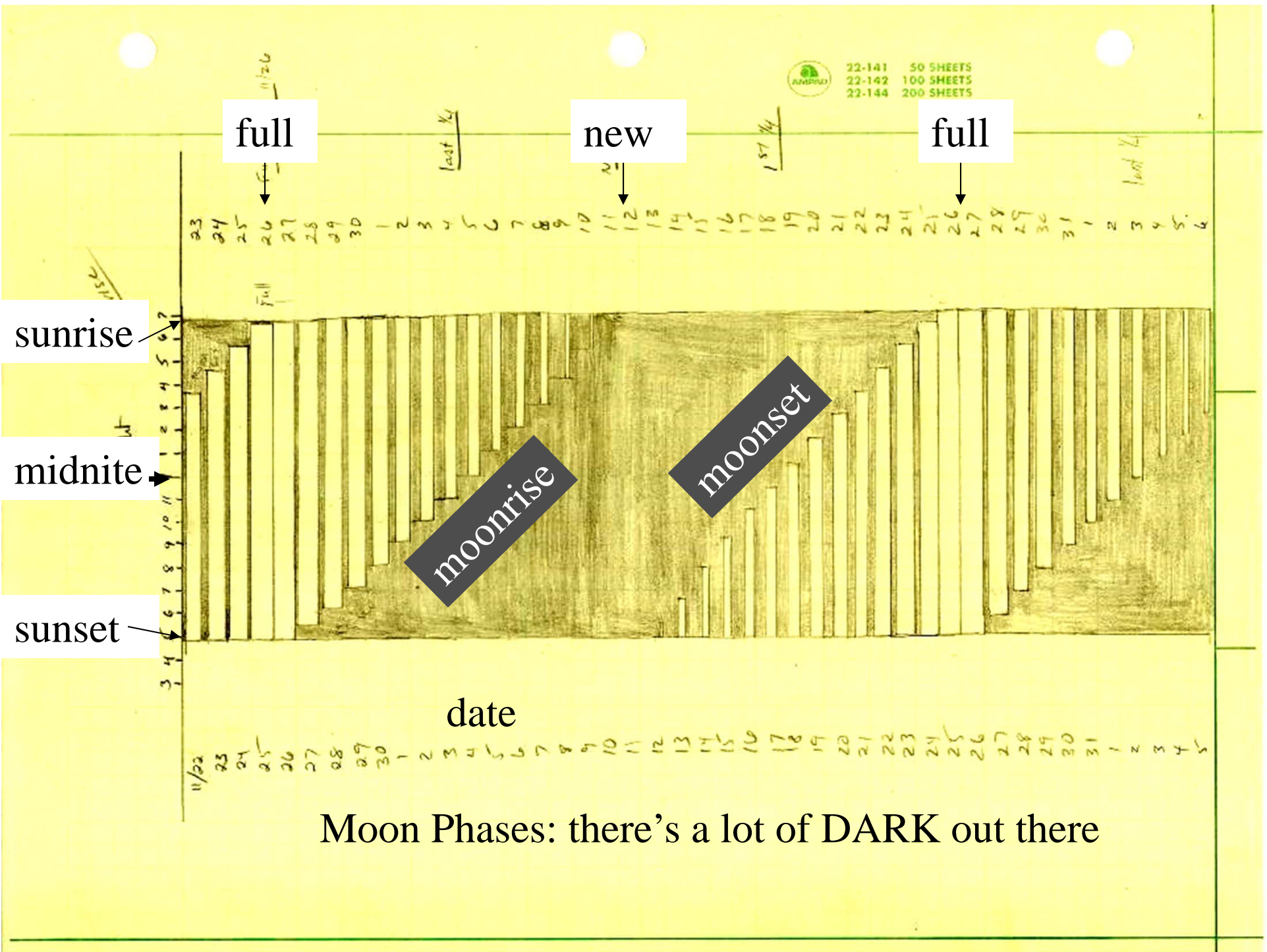
- A full moon gives over half a million times less light than the sun
- Half moon: 10% of a full moon
- Crescent moon: 1% of a full moon
- A moon low in the sky gives less light
- Snow cover helps; cloud cover hurts
- City lights
- *On a DARK night, there is essentially NO light*



Moon phases

- If the moon rose at 19:30 yesterday:
 - About what time will it rise tonight?
 - What phase is it?
 - Will it give more or less light than yesterday?
 - Where is it?

28 divided by 24 = almost one hour/day change



Moon Phases: there's a lot of DARK out there

FAR's

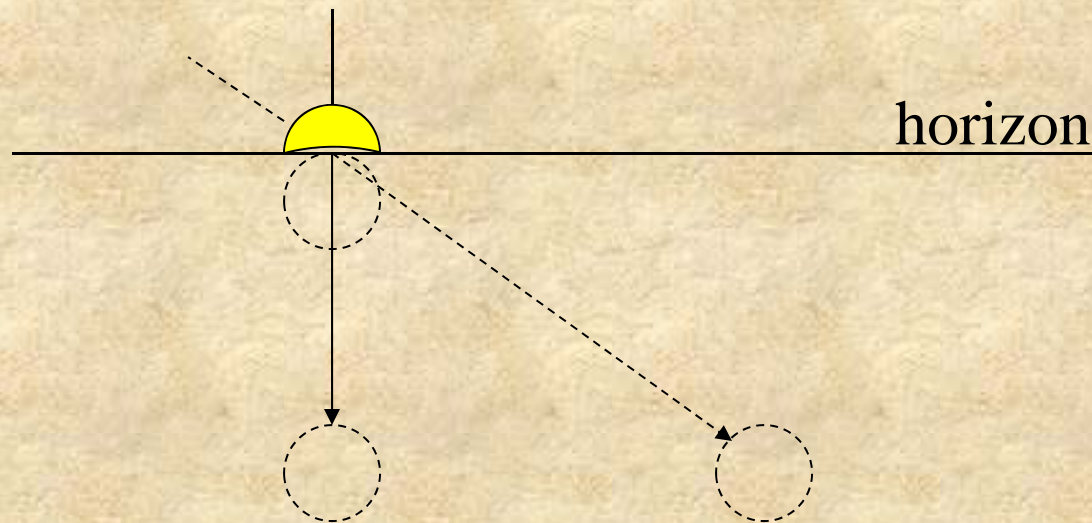
- Fuel reserves: FAR 91.15a2
- Three definitions of “night”
- Position lights req'd: FAR 91.209
 - Logging night landings for carrying passengers: FAR 61.57b
 - Logging night flying: FAR 1.1
- FAR 91.205: requires additional equipment for night flying

FAR's

- Fuel reserves: 45 minutes after destination
- Position lights req'd: sunset to sunrise
- Logging night landings for carrying passengers: 1 hr after sunset to 1 hr before sunrise
- Logging night flying: after evening civil twilight, before morning civil twilight
- Additional equipment: Anti-collision and Position lights, Electrical source, and Spare Fuses

End of Civil Twilight = Center of sun 6 deg below horizon

Sun: $\frac{1}{4}$ deg radius, moves at $\frac{1}{4}$ deg per minute



$6 \times 4 = 24$, $24 - 1 = 23$ minutes after sunset *at equator*.

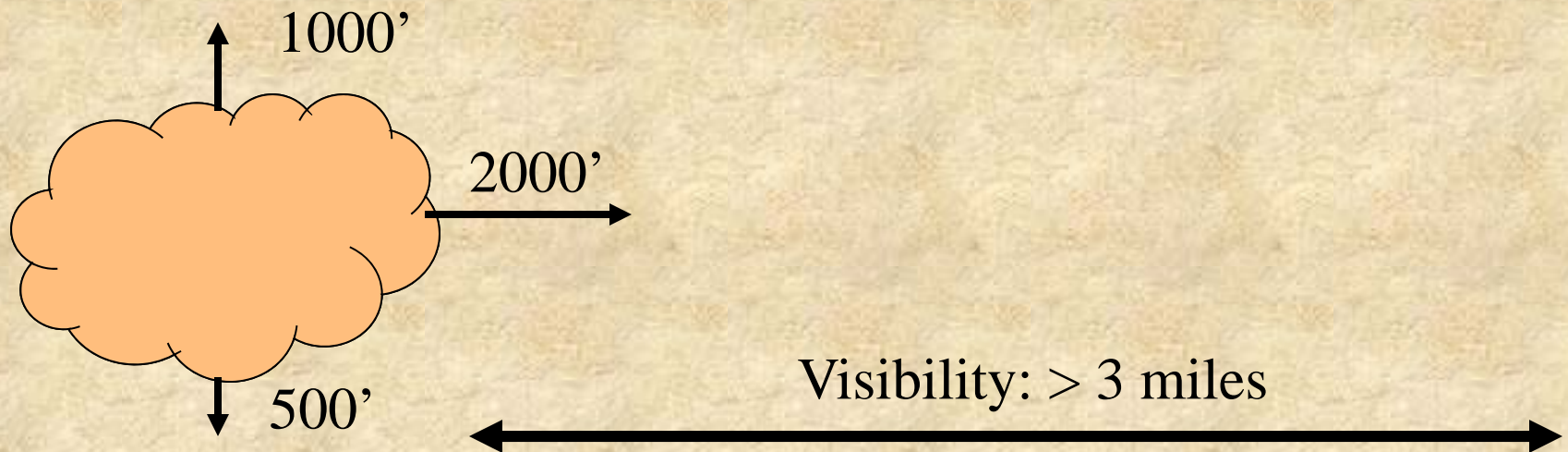
Longer at higher latitudes because of inclined descent

(Full dark: 18 deg below the horizon, but we don't care)

Currency vs. proficiency:
FAR currency requirements say
nothing about moon phases or
artificial/city lights

FAR's

- FAR 91.155: Cloud clearance and visibility requirements at night, E and G below 10,000'



FAR's

FAR 61.3e: an instrument rating is required
“in weather conditions less than the
minimums prescribed for VFR flight”

What is “weather”?

What is “visibility”?

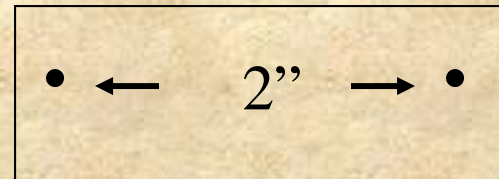
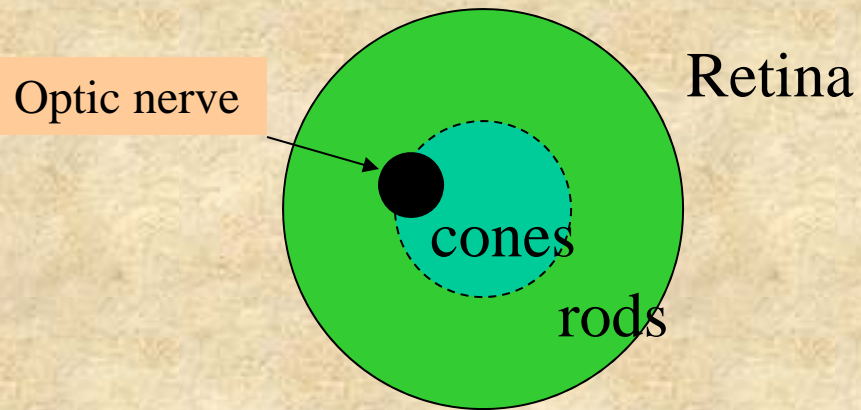
How do you maintain cloud clearance if you
can't see one?

CAPR 70-1, para 9.10.8.2

- For extended over-water operations: “both front-seat crew members must be CAP qualified mission pilots and instrument qualified and current. The right-seat pilot need not be qualified in the specific aircraft.”

Physiology: Vision

- Cones vs rods
- Colors
- Two blind spots



Physiology: vision

- Adaptation time
 - 100 x sensitivity in 5-10 minutes
 - Pupil dialation
 - 100,000 x sensitivity in 30-40 minutes
 - Chemical generation within rods
 - Chemicals quickly destroyed by white light

Physiology: vision

- Altitude
 - 20% night vision loss at 6000 ft
 - Oxygen helps restore
- Depth perception loss
 - Judging distance
- Map and instrument reading requirements vs. ability to see outside references

Physiology: Fatigue

- Circadian rhythms
- End-of-the-day fatigue
- Stretching, eating
- Crew interactions

*Illusions must be
anticipated*

Illusions: Banking seems like a climb

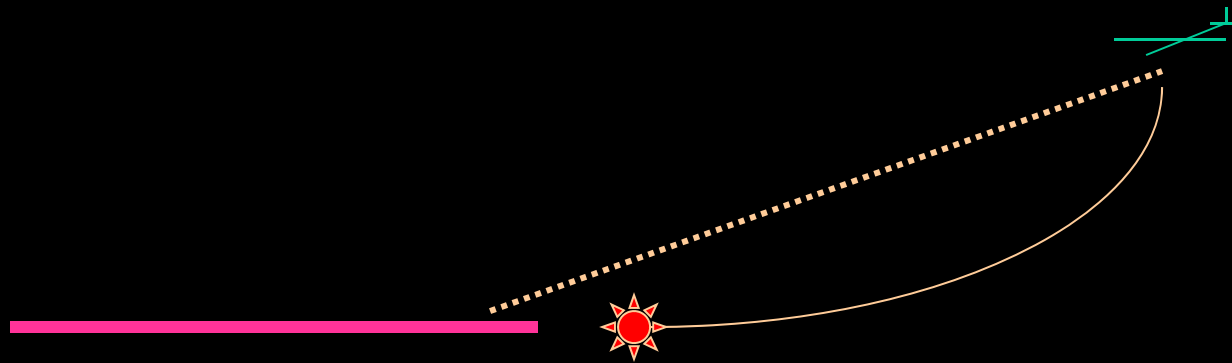


Illusion aftermath

June, 2004, Las Cruces



Illusions: Black hole illusion



Illusions: Which light is closer?

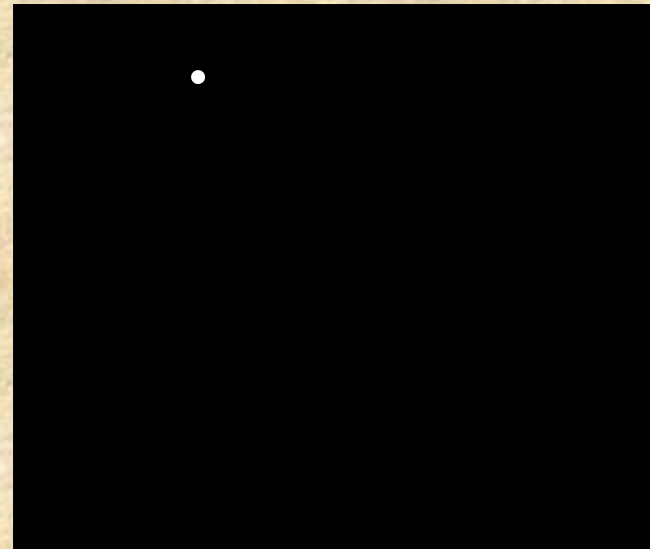
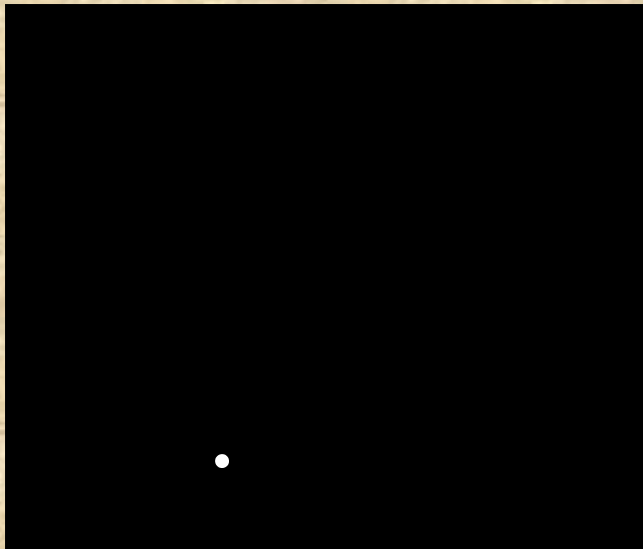


Illusions

- A bright light seems closer
- A dim seems farther away
- But it ain't necessarily so

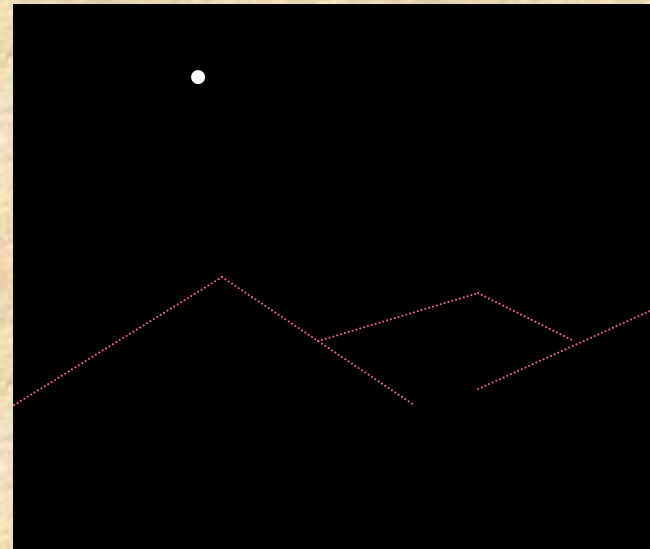
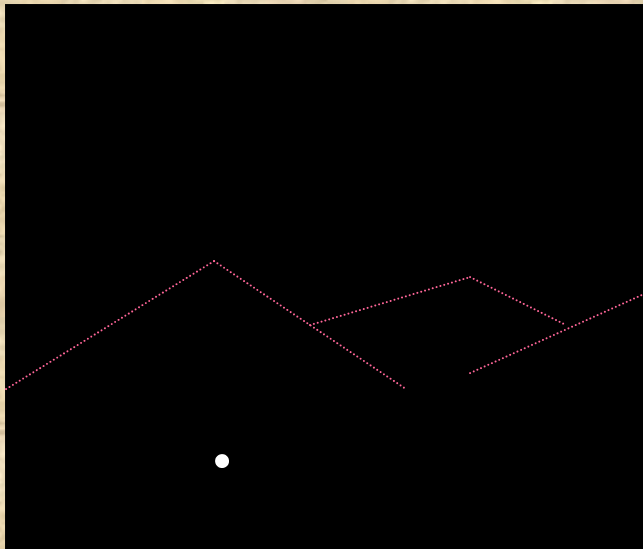
Illusions

- Which view out the windshield shows a climb?



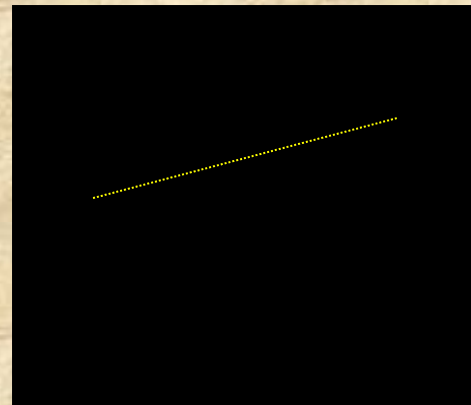
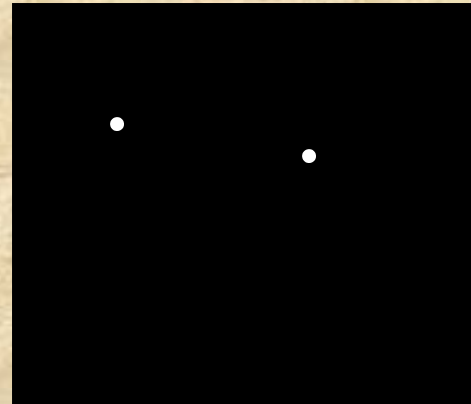
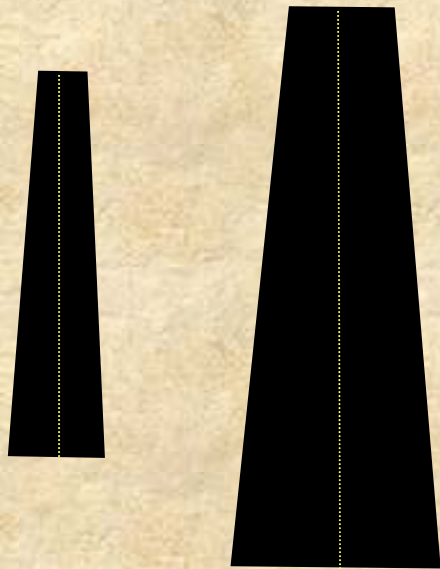
Illusions

- Answer: Neither. Nose up/nose low illusion



Illusions

- Planets, street lights
- False horizons
- Size illusions



Illusions

- Window reflections
- Snow
- Dark left/bright right

Vertigo

- Vertigo is more common at night
- Flicker vertigo
- Vertigo avoidance
 - Don't close your eyes
 - Don't move your head in a turn

Preparation

- Risk reduction: Consider the two-pilot crew
- Familiarity with aircraft systems and performance
- Blindfold cockpit check
 - Minimum distraction finding something
 - Finding the right knob
 - Avoid pulling wrong knob
 - Throttle/prop/mixture/fuel pump
 - Lighting
 - Alternator

Equipment

- Flashlight
 - spare batteries and bulbs
 - *spare flashlight*
- Clear glasses (transition from sunglasses at dusk)
 - spare glasses
- Portable GPS
- Handheld radio
- Keep all items within easy reach!

Airport Facilities Directory

A/FD

- For Destination AND Departure Airport
- Lighting (runway, PCL,etc)
- Check NOTAMS for inop lighting systems
- Obstacles
- Tower/FBO hours
- Call ahead for local info

Santa Fe

- Elevation: 6348'
- Lighting:
 - VASI on runways 2, 02
 - PVASI on runway 15 but NOTAMed inop
 - REIL on runway 33
- Lighting control: constant low intensity
- Frequencies: 119.5 CT, CTAF after 10 PM

FAA INFORMATION EFFECTIVE 25 NOVEMBER 2004

Location

FAA Identifier: 0E0

Lat/Long: 34-59-08.1830N / 106-00-34.0780W
34-59.136383N / 106-00.567967W
34.9856064 / -106.0094661
(estimated)

Elevation: 6199 ft. / 1889 m (estimated)

Variation: 11E (1995)

From city: 2 miles SE of MORIARTY, NM

Airport Operations

Airport use: Open to the public

Sectional chart: [ALBUQUERQUE](#)

Control tower: no

ARTCC: ALBUQUERQUE CENTER

FSS: ALBUQUERQUE FLIGHT SERVICE STATION [1-866-449-5390]

NOTAMs facility: ABQ (NOTAM-D service available)

Attendance: 0800-2000

Pattern altitude: 7199 ft. MSL

Wind indicator: yes

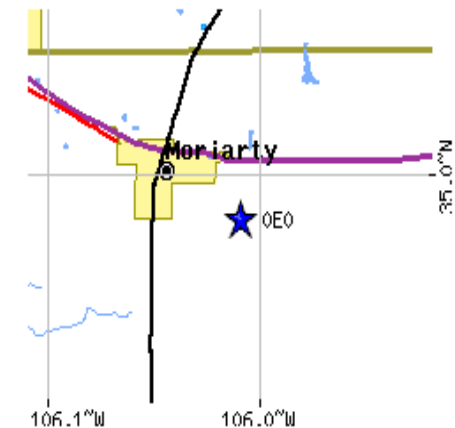
Segmented circle: yes

Lights: DUSK-DAWN

Beacon: white-green (lighted land airport)



[Loc](#) | [Ops](#) | [Rwy](#) | [IFR](#) | [FBO](#) | [Links](#)
[Com](#) | [Nav](#) | [Svcs](#) | [Stats](#) | [Notes](#)



Airport distance calculator

Flying to Moriarty Airport? Find the

NDB name [↖] **Hdg/Dist Freq Var ID**
ISLETA 079/30.0 247 11E ILT .. -... -


Airport Services


Fuel available: 100LL
FOR FUEL AFT HRS & HOLS CALL 505-832-2222.

Parking: hangars and tie-downs
Airframe service: NONE
Bottled oxygen: NONE
Bulk oxygen: NONE

Runway Information

Runway 8/26

Dimensions: 7700 x 75 ft. / 2347 x 23 m	
Surface: asphalt, in good condition	
Runway edge lights: medium intensity	
MIRL OTS INDEFLY.	
Runway edge markings: RY 08/26 STRIPES FADED.	
RUNWAY 8	RUNWAY 26
Traffic pattern: left	left
Markings: nonprecision, in poor condition	nonprecision, in poor condition
Runway end identifier lights: yes	yes



METAR

K4MY 231500Z 03004KT 1/2SM FG
2nm SW VV001 M21/M23
KCQC ASOS 505-472-4551
17nm E 231553Z AUTO 00000KT 8SM
CLR M13/M16 A2999 RMK AO2
SLP231 T11331156 FZRANO
TSNO \$

TAF

KABQ 231136Z 231212 13007KT
30nm W P6SM SCT050
FM1500 03006KT P6SM SCT050
SCT200
FM1900 04010KT P6SM VCSH
SCT050 BKN060 BKN120
PROB30 2203 09015G25KT 2SM
-SN SCT020 BKN030
FM0300 09020G34KT P6SM
VCSH SCT030 BKN040 PROB30
0306 2SM -SN BR SCT020
BKN030
FM0600 07015KT P6SM SCT040
SCT100
TEMPO 0609 BKN040

Moriarty

- Elevation: 6199'
- Lighting:
 - MIRL
 - REIL (“OTS indef”)
- Lighting: available, control not specified
- Frequencies: 122.9 CTAF

Estancia

- Elevation: 6100'
- Lighting: ODALS; runway edge “retro-reflective” lighting
- Lighting control: unspecified
- Frequencies: 122.9
- Other: cattle; soft when wet

Preflight Airplane Inspection

- Perform in Daylight if possible
 - Fuel sample color
 - Stains, leaks
- Include aircraft lighting tests
 - Nav/taxi/landing/interior/panel/strobes

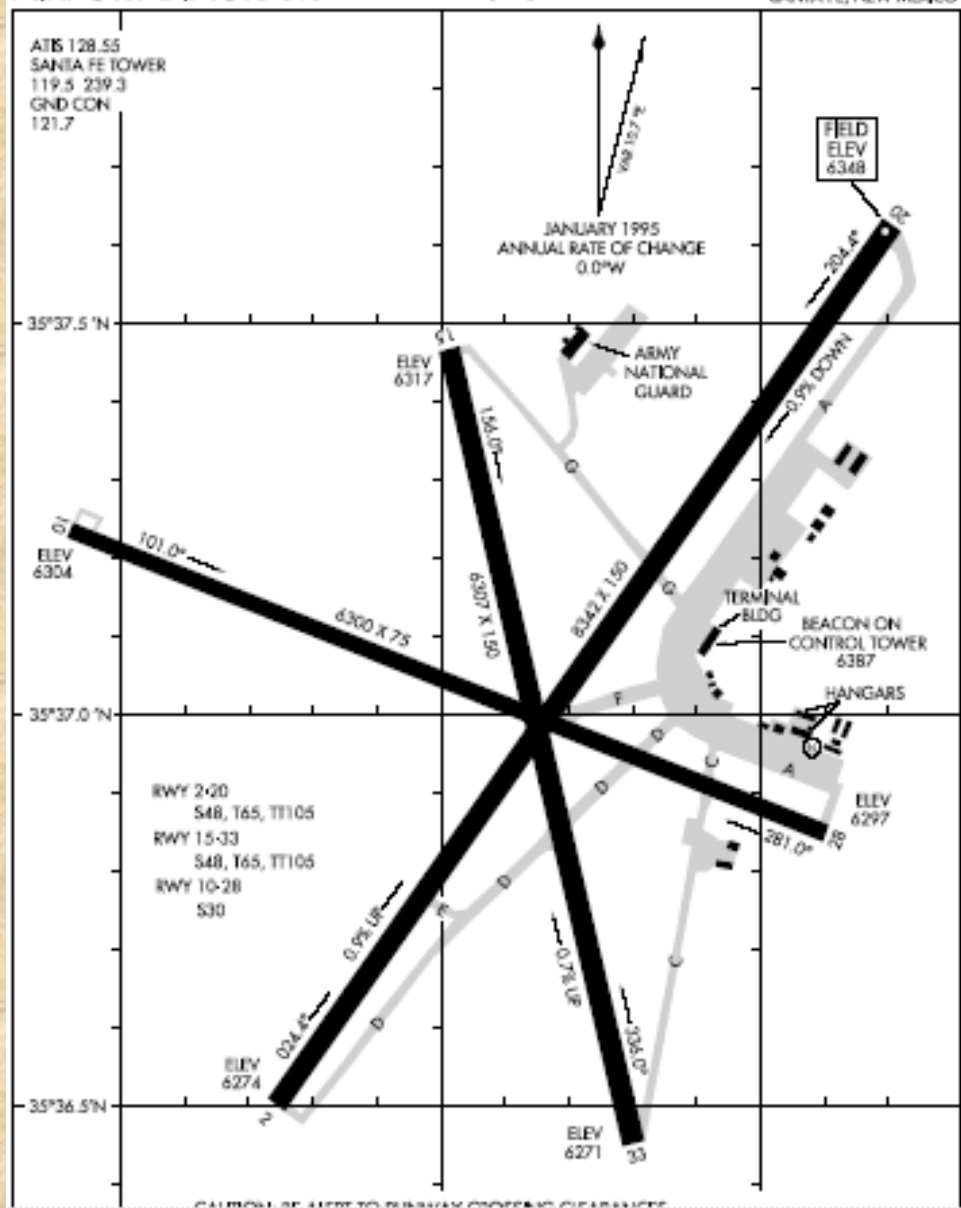
Taxiing

- IFR instrument checks
- Strobes off
- Landing lights off
 - Melted lenses
 - Blind oncoming traffic
 - Battery drain
- Keep the centerline, especially when turning off the runway
- Pedestrians: you can't see them, they can't see the prop

AIRPORT DIAGRAM

AL-548 (FAA)

SANTA FE MUNI (SAF)
SANTA FE, NEW MEXICO



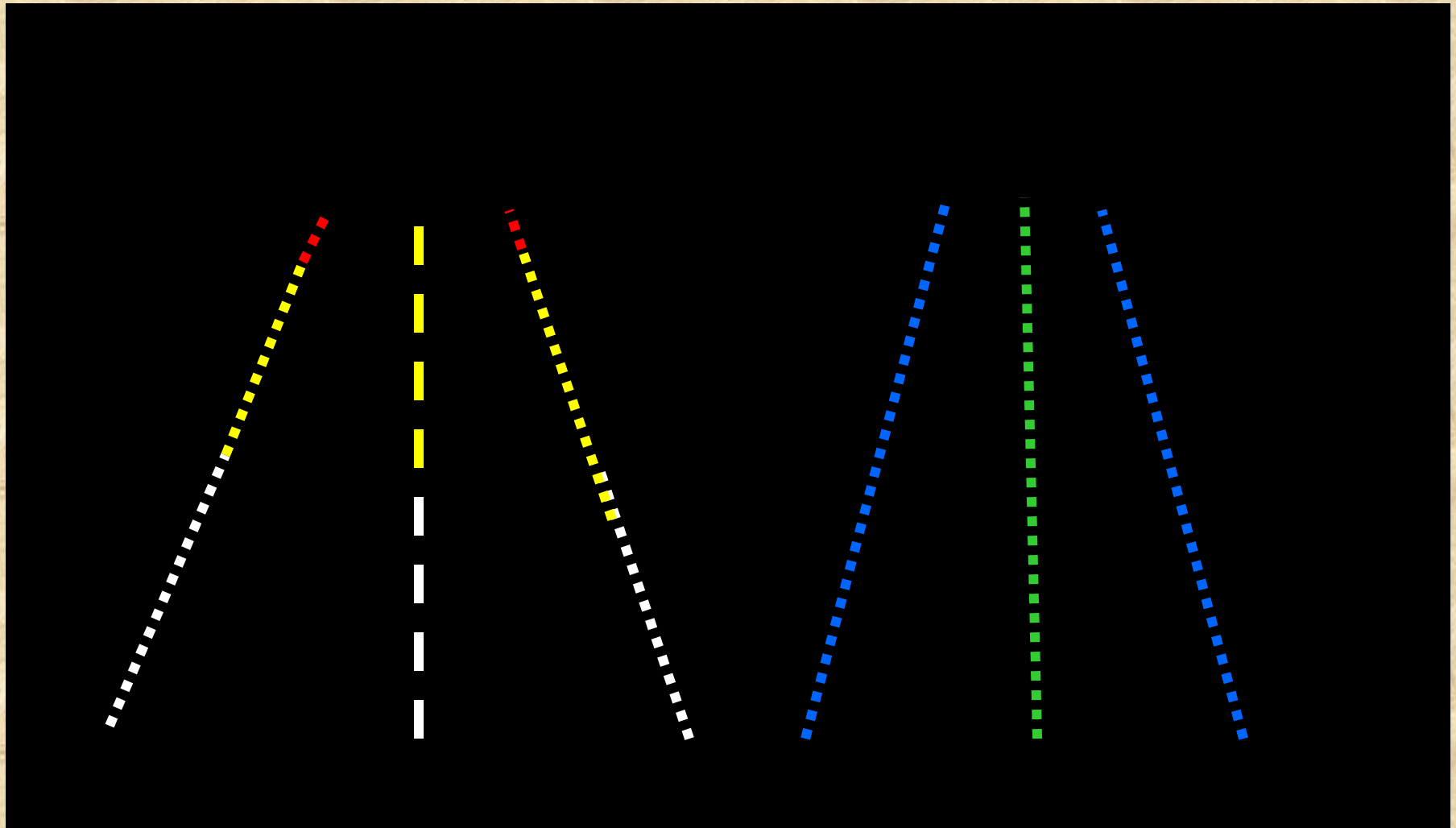
Watch your taxi speed and keep your attention outside the A/C when it is in motion



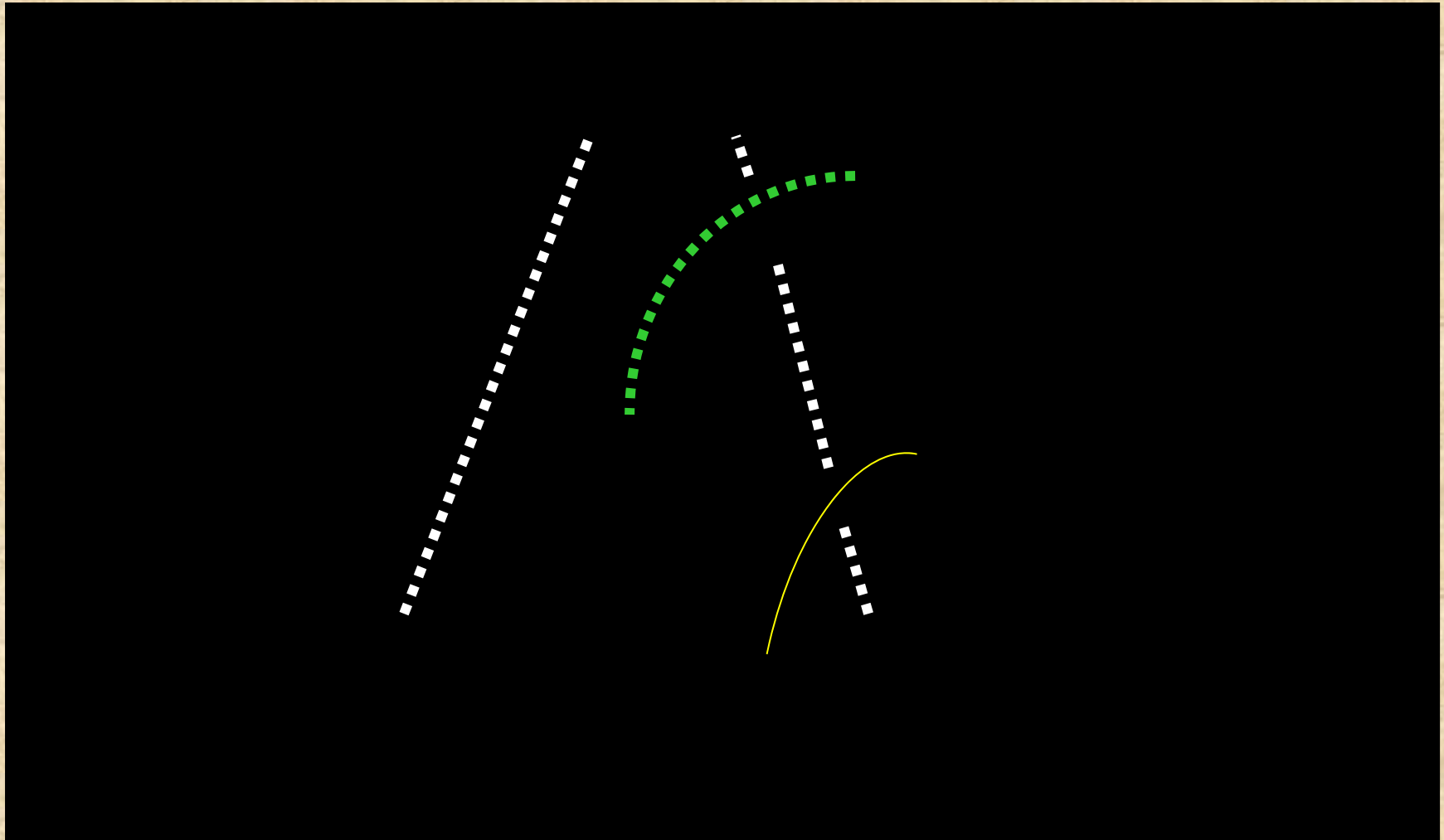
Airport Lighting

- Runway
 - White (last 2000 ft are yellow)
 - REIL strobes
 - Threshold (Red/Green)
- Taxiway lights are blue
 - Taxi centerline lights are green
 - Turnoff lights are “peas and carrots”
 - Hold-short lights are flashing yellow
- Beacon (green/white, green/white/white)

Taxiing: Lighting colors



Taxiing: runway turnoffs



Takeoffs

- Back-taxi on a remote runway to clear it of animals and parked lovers
- Runway lights are a *necessity* for takeoff
- IFR if black night: no attitude reference
 - Use airspeed, AI, altimeter



Verify that all passengers are properly seated and secured



Climbout and Departure

- Use IFR Departure Procedures when available
- Transition to instruments
 - Use the AI
 - Use standard rate turns to minimize chances for vertigo
- Know the terrain
 - Review the sectional
 - View the terrain in daylight if possible

Types of Departure Procedure

- ATC (clearance/departure control/tower)
- SID or  Std IFR Procedure
- Use the sectional
- GPM

SANTA FE, NM

SANTA FE MUNI

TAKE-OFF MINIMUMS: Rwy 28, 1300-3 or std. with min. climb of 240' per NM until passing 7300 MSL.

Rwys 2, 33, Cats. C and D, 2900-3 or std. with min. climb of 330' per NM until 9000 MSL.

DEPARTURE PROCEDURE: Rwys 2, 10, 33, turn right; Rwys 20, 28, turn left; Rwy 15, climb runway heading.

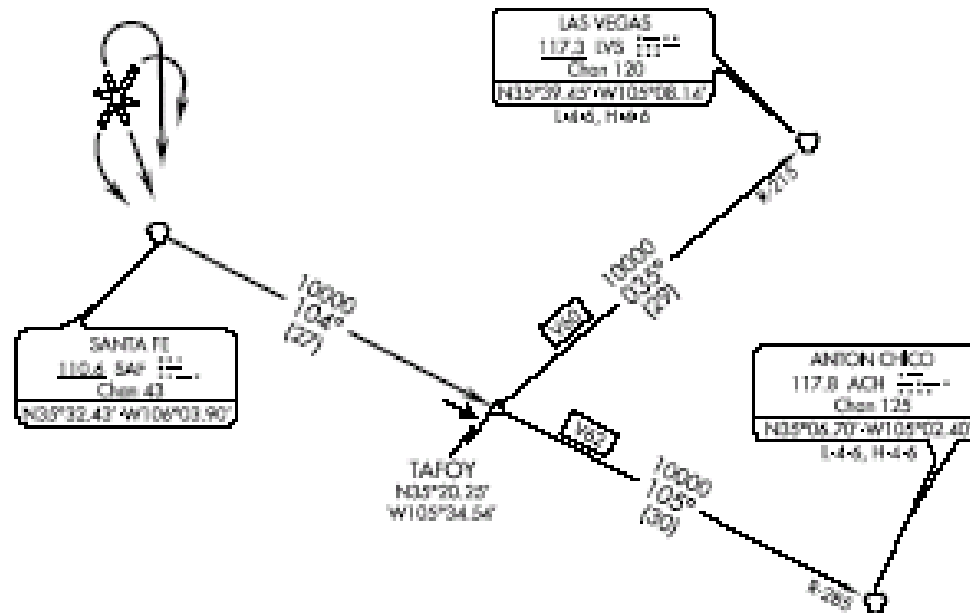
All aircraft climb direct to SAF VORTAC. Continue climbing in SAF VORTAC holding pattern (hold SE, right turns, 332° inbound) to cross SAF VORTAC at or above airway MEA/MCA for direction of flight.

TAF0Y ONE DEPARTURE

SI-548 (FAA)

SANTA FE MUNI (SAF) /
SANTA FE, NEW MEXICO

ATS 138.55
GND CON
121.7
SANTA FE TOWER*
119.5 (CTAF) 339.3
ALBUQUERQUE CENTER
132.8 348.35



CAUTION: Mountainous terrain all quadrants.

NOTE: Takeoff runways 2, 33: Cat. A, B standard;
Cat. C, D requires a minimum climb of 330'/NM until
passing 9800' or a 2900' ceiling and 3 miles visibility.

NOTE: Clear not to scale.



DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RUNWAY 15: Climb direct to....

TAKE-OFF RUNWAY 20: Climbing left turn direct to....

TAKE-OFF RUNWAYS 2 & 33: Climbing right turn direct to....

....the SAF VORTAC. Proceed via the SAF R-104 to TAF0Y INT, climb and maintain 10000 MSL. Thence via assigned (transition) or (route).

ANTON CHICO TRANSITION (TAF0Y1.ACH): From over TAF0Y INT, via V62/ACH R-285 to ACH VORTAC. Thence via (assigned) route.

En Route

- Plan route via airports, over interstates, and using available lighting
 - Avoid rough terrain and stay over lower elevations
 - Different landmark/checkpoint strategy for pilotage
 - Radio navigation is often primary
- Fly high:
 - Avoiding terrain by procedure (routing & altitude) rather than visual separation
 - Altimeter setting is important to avoid marginal terrain
 - More glide distance
- IFR techniques and competencies are useful
 - Use airways, MEA & MOCA for terrain clearance
- Monitor engine instruments more thoughtfully
- Electrical more critical
 - Ammeter is usually the first hint of trouble
 - Dimming lights – weak radio reception are also indicators
- WX - Respect low ceilings and visibilities

SAF to Moriarty

Initial routing looks reasonable.

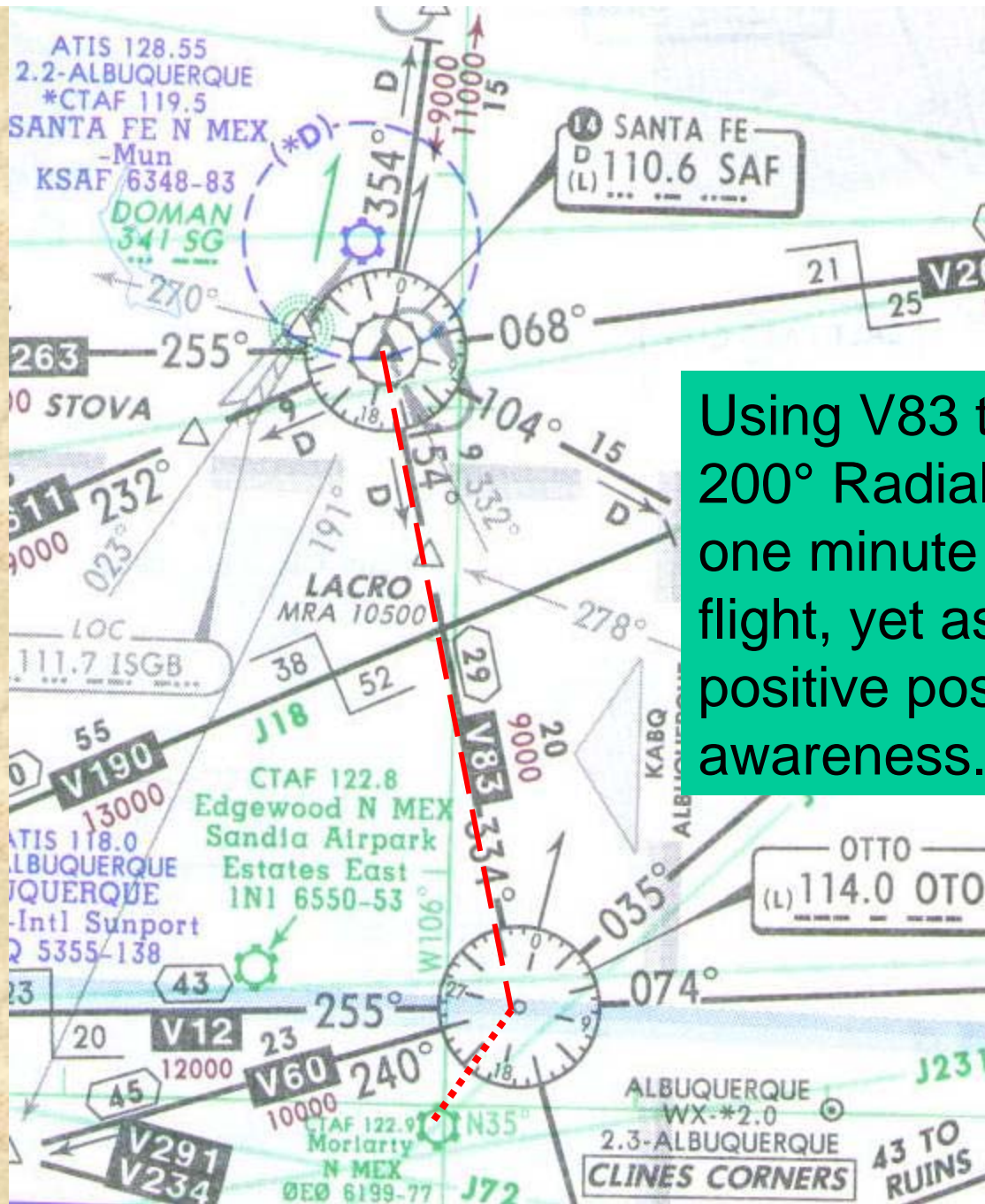
But:

What if the turn to 'on course' is delayed perhaps at the towers request to clear traffic?

What if the compass, DG. Or your attention to heading wanders?

What if the visibility is only the 'legal' 3 miles?





Using V83 thence the 200° Radial will add one minute to the flight, yet assure positive positional awareness.

Descent

- Delay descent until *positive ID* of destination airport
 - Rotating Beacon
 - Surrounding lighting
- Sudden foreground occlusion is a warning bell
- Modified IFR approach
 - Make regular cockpit callouts of airspeed and AGL altitude



Landings

- Determining wind direction
 - ATIS
 - Onboard GPS
 - Illuminated windsocks
- Drag a remote runway to clear it and to check the wind
- Use VASI or ILS if available
- Once on final, only a landing or a full go-around are allowed
- Avoid straight-ins: difficult to judge altitude and distance at an unfamiliar runway



Landings

- Deliberately fly the approach to cross the runway threshold at 100 ft AGL
 - Allows a margin for altimeter error
 - Avoids black hole error
- Flare is typically inadvertently low
- Use a soft-field technique
- Judgment – divert if conditions are unsafe



Emergencies

- Loss of engine
 - Head for the dark?
 - Head for the light?
 - Trim nose up, flaps, into the wind

Not all dark areas are suitable landing sites

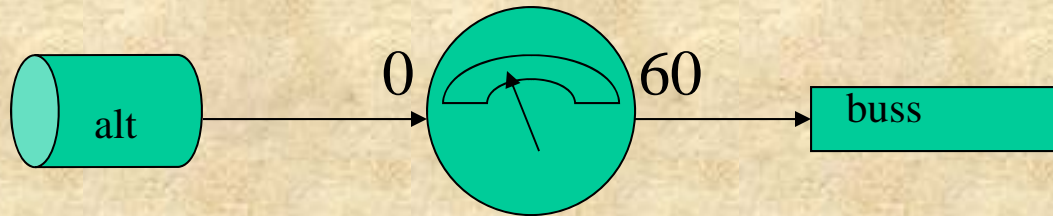


Emergencies

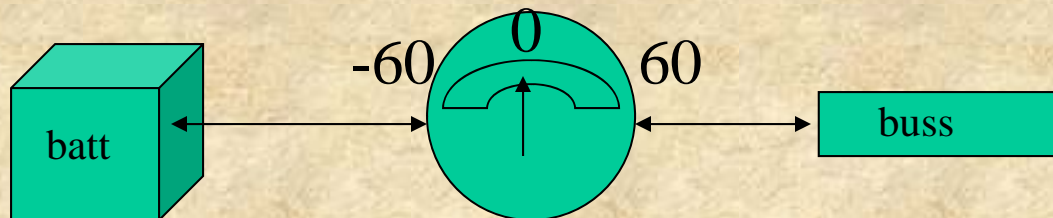
- Loss of electrical
 - No aircraft lighting
 - You can't see (instruments, landing)
 - You can't be seen by other traffic
 - No Pilot Controlled Lightning
 - No navigation
 - No flaps, landing gear?
 - Soft field landing

Know your systems

Loadmeter: “0” = emergency; +20 = normal



Ammeter: “0” = normal; +/-20 = emergency



Electical Discharge

- Reset the alternator
- Turn off all but essential equipment
 - Transmitter: 5 amps
 - Transponder : 2 amps
 - Nav radio: 1 amp
 - Receiver: 1/2 amp
 - Lighting, heater, gyros?

Electrical Overcharge

- Turn off electrical
- Turn off the alternator field, let it cool and then try to reset it
- Pull the alternator circuit breaker
- Know the locations of switches and circuit breakers

Emergencies

- VFR into IMC
 - Execute the classic 180 turn and get out of Dodge. Now!
- Inop cockpit lights
 - Just how handy really is your flashlight?
 - Have the copilot hold it

Emergencies

- Inoperative runway lights
 - Is it really pilot controlled lighting, or should you have called the manager and asked to have them turned on manually?
 - Maybe you're not where you think you are.
- If you don't have runway lights, you don't have a landing target. **DIVERT**

Night Weather

- Temp-Dewpoint trends
- Clues for low level haze
- Can't see clouds on a dark night: clues for clouds
- Beware VFR into IMC
- Spatial disorientation: JFK Jr.

Useful IFR techniques

- MEA, MOCA, MRA, MCA, etc.
- Standard rate turns
- Departure Procedures
- Altimeter settings
- Situational Awareness

Retro-reflector runway lighting

- Cannot see panels until 1.5 miles out
 - Must be aligned with runway
- Pilot/radio activated strobes
- Wing-mounted landing lights are off-center
- X-wind crab vs. landing-light aim
- Use flaps for better vertical light aiming

Night Flight Training Profile

- PREFLIGHT
 - Discussion/briefing of flight profile
 - Review Notams, A/F D for departure and destination info
 - Query for Terrain awareness:
 - departure and destination airports, enroute
 - Observe Preflight inspection
 - Verify Equipment inspection
 - Challenge Cockpit organization
 - Perform Blindfold cockpit test

Night Flight Training Profile

- TAXI
 - Highlight IFR instrument taxi tests,
 - Verify ammeter check
 - Discuss airport lighting during taxi
- Departure Airport
 - Observe take-off and transition to black conditions
 - Perform initial landing(s) at well-lit airport
 - Note availability of VASI, PAPI, ILS as appropriate

Night Flight Training Profile

- EN ROUTE
 - Turn-off inside lighting
 - Note lack of visual cues
 - Verify
 - Instrument scan
 - Navigation ability
 - Situational Awareness
 - Terrain awareness
 - Demonstrate
 - Off-center outside scan
 - Illusions: bank = climb; nose up = high; stars = lights; false horizons

Night Flight Training Profile

- Destination Airport
 - Locate destination airport
 - Identify traffic pattern entry
 - Demonstrate pilot controlled lighting
 - Verify altitude and airspeed awareness
 - Perform all turns at standard rate
 - Execute landings at black-hole airport
 - Also practice emergency landings with no landing or cockpit lights, no flaps
 - Verify judgment to abort or divert if conditions not suitable

Be Safe out there in the Dark!