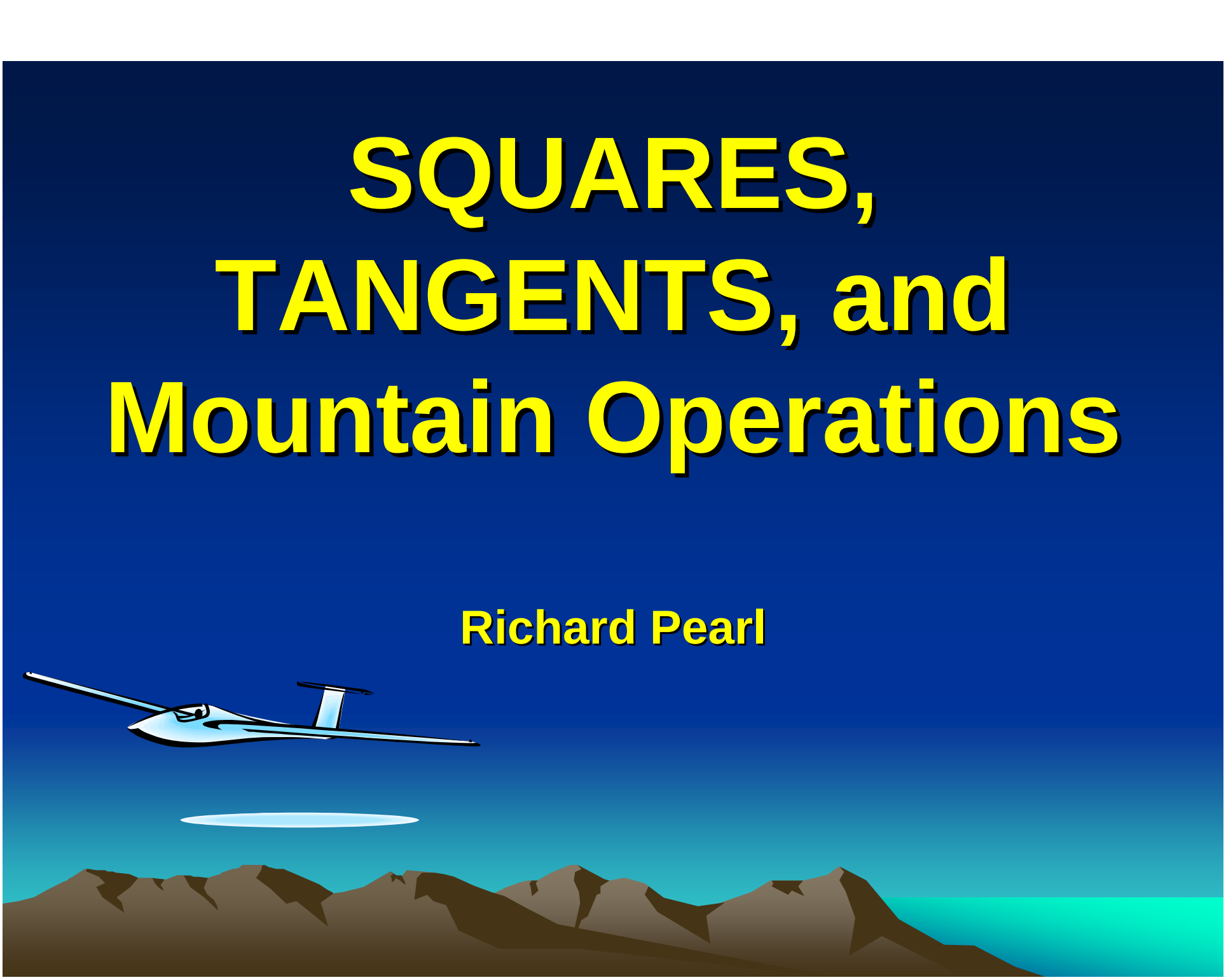
SQUARES, TANGENTS, and Mountain Operations

Richard Pearl



High Altitude…
Low Altitude

What's the Big Deal?

FAMOUS AVIATION SAYINGS

- A Good Landing is Where The Plane Can be Used Again (immediately)
- I Can Put the Ship down Anywhere; Here, Watch Me
- Runway Behind You is Useless
- Take-Offs Are Optional…

  Landings are Mandatory

Definitions:

- **Pressure Altitude: Altitude Indicated on an Altimeter set to barometric pressure of 29.92**
- **Density Altitude: Pressure Altitude Corrected for Non Standard Temperature (59 degrees F)**
- **True Airspeed: Actual airspeed of the aircraft through the Air mass.**

Density Altitude

- Increased Pressure (lower altitude) = increased molecular compaction
- Higher altitude = Lower Pressure = decreased molecular pressure = higher true airspeed.
- Indicated airspeed is the Same at all Levels Except that True Airspeed Increases with Altitude

Points to Understand:

- True Airspeed Increases 2% per 1,000 ft. of altitude
- Each Knot of Airspeed > POH = Additional 100 Ft. (or 2%) of Runway Required *
- Each 10 Ft. Of Excess altitude at Threshold = Additional 200 ft. of Runway Required *

* Excl. use of Spoilers

Critical Points to Remember

- **Energy is Proportional to**

  Mass X Speed X Speed

- **Landing Distance Increases by the Square of the ratio of the True Touchdown Speed to Normal Speed**

Effect of Increased Speed on Landing: Assume 60 Kt. Normal:

- **Example 1:**
  - 66 Kts. Actual (10%);
    - 1.1 X 1.1 = 21% incr. in landing distance
- **Example 2:**
  - 60 Kts. + 5 Kts. (kids/Wife/dog) + 5 Kts. Anxiety = 70 Kts. X D.A. of 8,000 ft. (= 16% incr.) = 81 Kts. True Airspeed

21 Kts. (35%) = 1.35 X 1.35 = 82 % Incr. in landing distance (excludes panic braking)

Turn Radius/Diameter:

- **Turn Radius is Proportional to Velocity Squared:**

$$R = \frac{V^2}{g \tan(b)}$$

45 degree bank = $V^2/11.26$

At 60 Kts.: 60 X 60/11.26 = 320 ft.

At 80 Kts.: 80 X 80/11.26 = 568

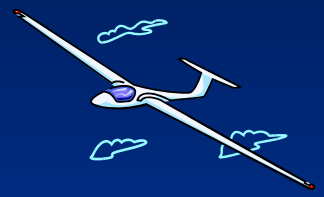
+248 X 2 =

498 ft Extra Ft.

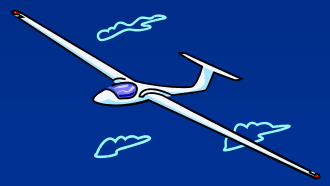
Turn Radius:

30 Degree Bank

40 Kts True;
185 ft.



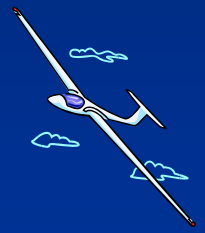
60 Kts True;
417 ft.



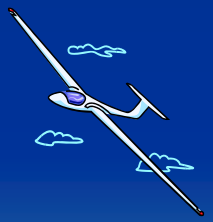
80 Kts True;
740 ft.

45 Degree Bank

40 Kts True;
107 ft.



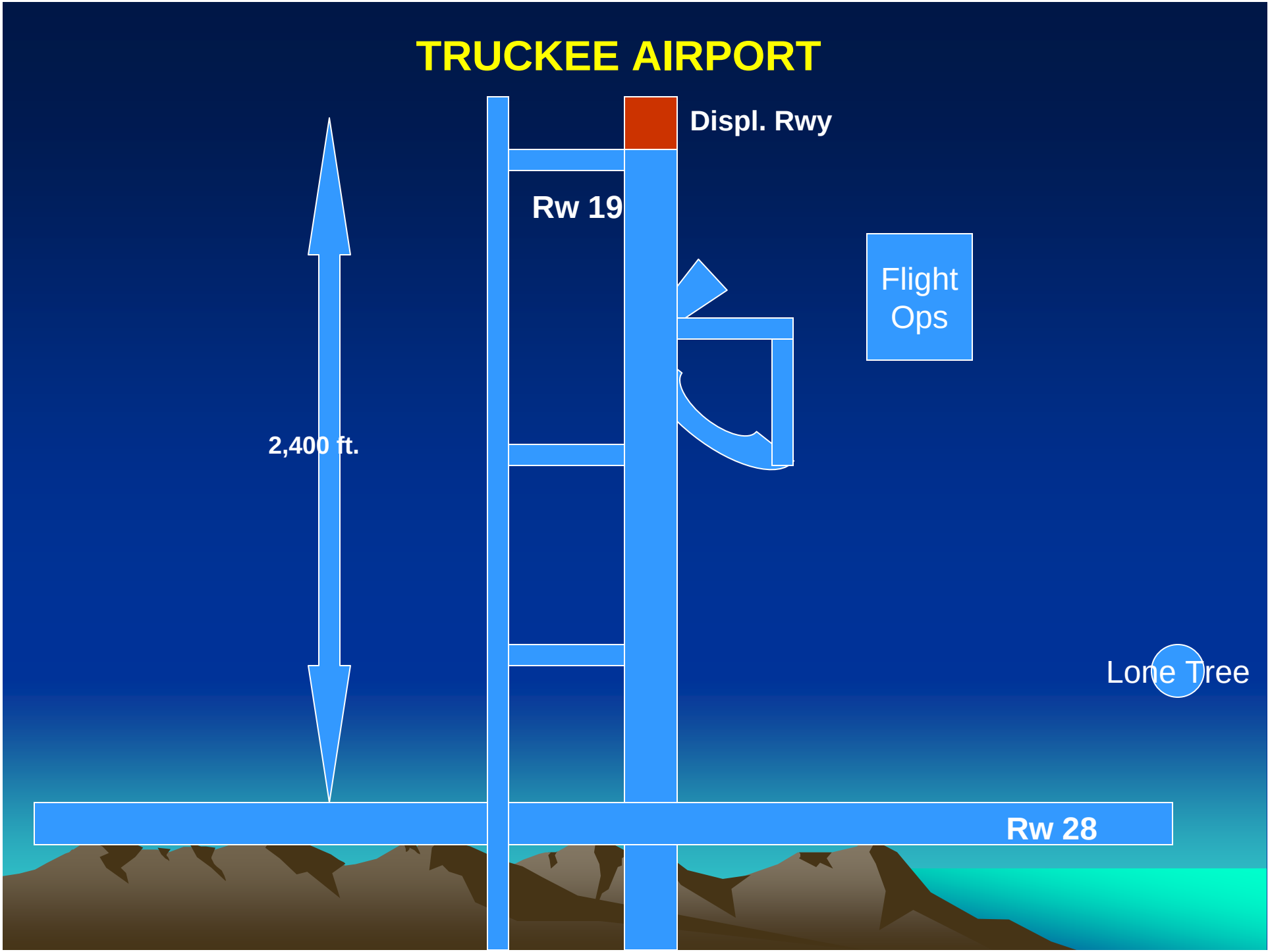
60 Kts True;
240 ft.



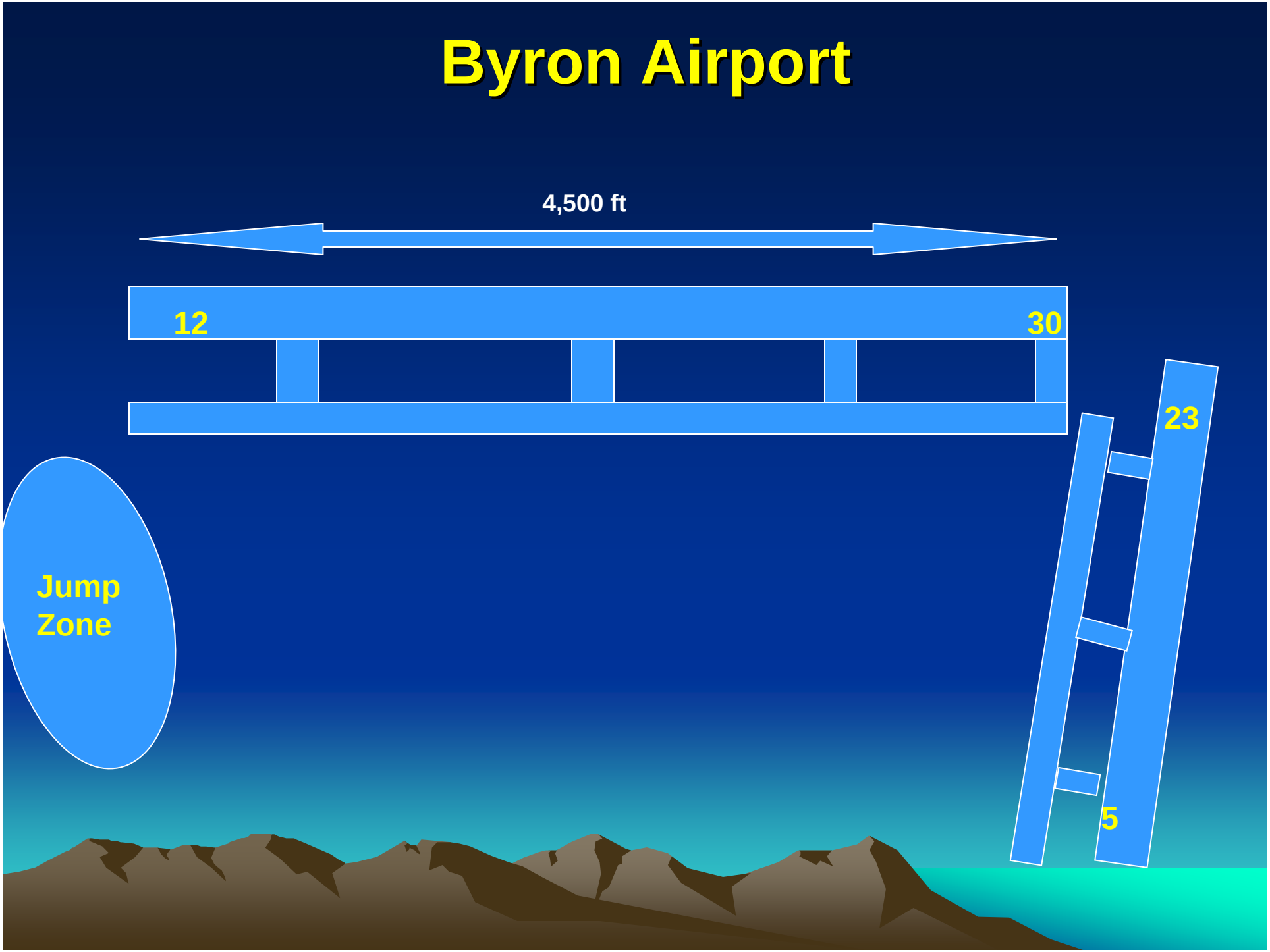
80 Kts True;
428 ft.

Note: Turn from Downwind to Final is *2X above*

REAL LIFE FLYING,
OR
WHAT DOES THIS MEAN TO ME?


TRUCKEE AIRPORT
Displ. Rwy
Rw 19
Flight Ops
2,400 ft.
Lone Tree
Rw 28

Byron Airport



Summary

- Safety is Job # 1; Precision is Job # 2
- Speed is the Enemy of Precision
- How Do You Get To Carnegie Hall?....