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NBAA

Aircraft Performance Basics

Wednesday, February 8 | 1:00 PM – 2:30 PM

PRESENTED BY:

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SCHEDULERS & DISPATCHERS CONFERENCE

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“Performance”

We have all heard the word but what does it actually mean?

In simplest terms, performance boils down to what one can expect from an airplane under a given set of conditions.

Contrary to what many individuals think, just because we were able to do a trip yesterday does not mean we will be able to accomplish it tomorrow.

Performance calculations are somewhat complex.

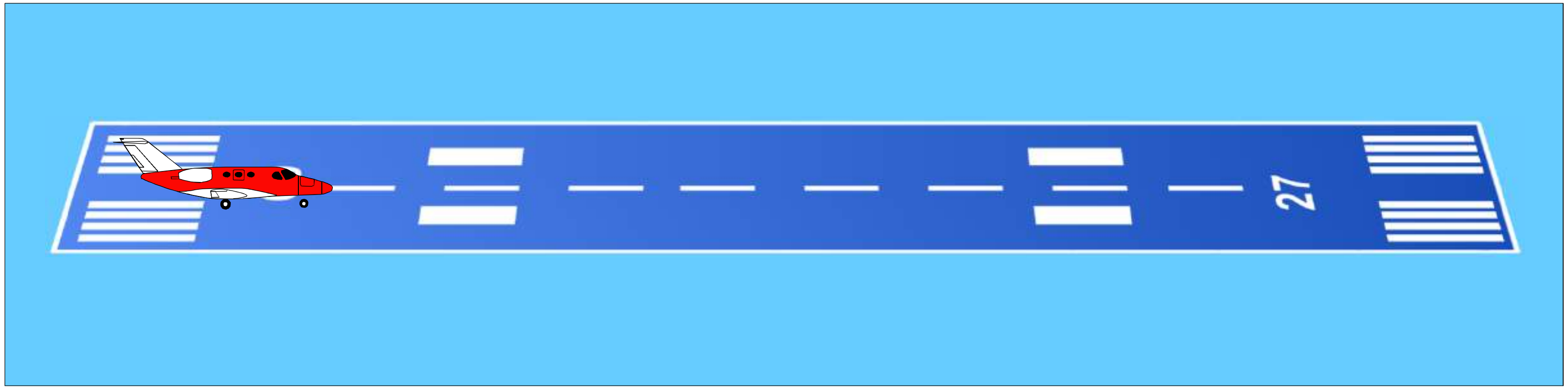
One must take into account:

- The airplane's capabilities and its mechanical condition
- The environment under which it is operating
- Regulatory requirements

Because of our limited time this afternoon, we will be focusing on just the basics.

You are more than welcome to ask anything you'd like during our question and answer period at the end of the presentation.

TAKEOFF PERFORMANCE



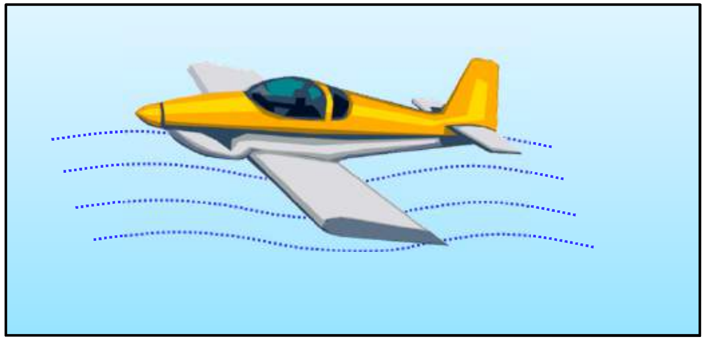
Under ideal conditions, runway length requirements are a function of weight.

However, we seldom operate in such an environment. Factors such as temperature, pressure, and wind have a profound effect on performance and must be taken into account.

TEMPERATURE & PRESSURE

Temperature and pressure affect air density.

Air density in turn, affects the amount of lift generated by the wing and thrust produced by the engines.



G450 Takeoff Planning: Dry Runway, Flaps 10° - APA Sea Level

AFM APP. A

TAKEOFF PLANNING CHART

DRY RUNWAY — AIRPORT PRESSURE ALTITUDE = SEA LEVEL — TAKEOFF FLAP 10°

74,600 LB MTOGW	OAT (°C)	50	45	40	35	30	25	20	15	5	-5	-15
***Without ASC 16	OAT (°F)	122	113	104	95	86	77	68	59	41	23	5
73,900 LB MTOGW	RATED EPR	1.55	1.57	1.60	1.63	1.66	1.66	1.66	1.66	1.66	1.66	1.66
-- 74,600 LB --												
	FLD LNGTH	8,320	7,710	7,180	6,710	6,270	6,170	6,080	5,980	5,820	5,620	5,430
VSE = 175 KCAS	V1 KCAS	149	148	146	144	143	143	143	143	143	143	143
VREF = 154 KCAS	VR KCAS	152	151	151	151	150	150	150	150	150	150	150
MAX TEMP = 50°C	V2 KCAS	157	157	157	157	157	157	157	157	157	157	157

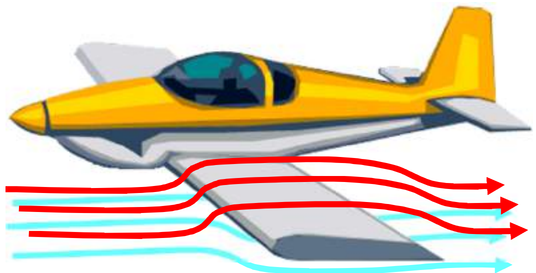
TAKEOFF PLANNING CHART

DRY RUNWAY — AIRPORT PRESSURE ALTITUDE = 6,000 FEET — TAKEOFF FLAP 10°

-- 74,600 LB --												
	FLD LNGTH	******	11,380	10,470	9,670	9,020	8,720	8,570	8,440	8,140	7,840	7,540
VSE = 178 KCAS	V1 KCAS	******	154	152	150	149	149	149	149	149	149	150
VREF = 155 KCAS	VR KCAS	******	155	155	155	155	155	154	154	154	154	154
MAX TEMP = 35°C	V2 KCAS	******	160	160	160	160	160	160	160	160	160	160

WIND

Lift is generated as a result of airflow over the wing.

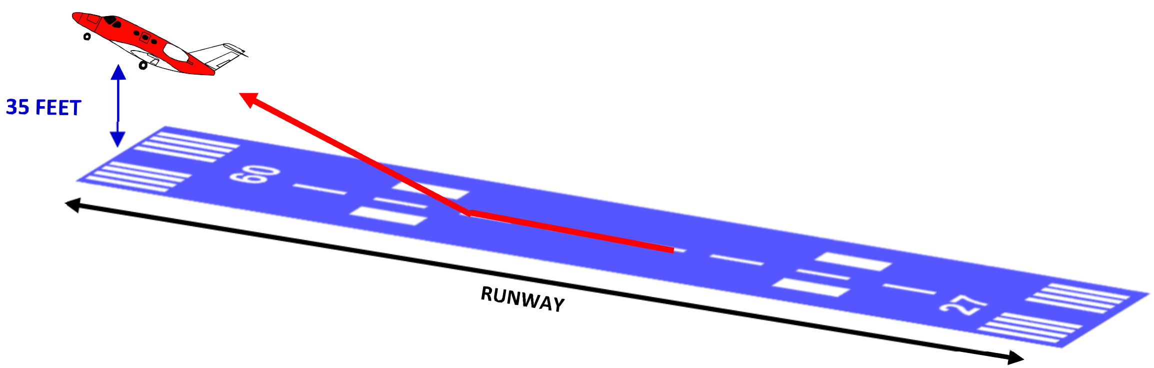


We may need to generate the entire airflow ourselves, take advantage of headwinds, or have to overcome the negative impact of tailwinds.

CLIMB REQUIREMENTS

Aircraft must be able to achieve minimum climb rates after takeoff. These rates may need to be further increased when there are obstacles on the departure path.

Climb performance is a function of weight, air density, and aircraft configuration.



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VISIBILITY

Although not a performance issue, we must have sufficient visibility to enable the pilots to track straight down the runway and see/avoid nearby obstacles.

CONTAMINATION

Contaminants such as snow, slush, or standing water may hamper directional control and make it impossible to stop the aircraft during an aborted takeoff.

RECAP

- Hot temperatures and low atmospheric pressure decrease air density reducing lift and our weight carrying capability.

- Headwinds allow us to takeoff with more weight or from shorter runways while tailwinds have the opposite effect.

- Obstacles, visibility, and runway contamination can be a concern at times.

CRUISE PERFORMANCE

As a rule, we generally want to:

- Fly as high as the aircraft's weight permits
- Take advantage of tailwinds when available

Performance Handbook **Gulfstream G450**

TWIN ENGINE CRUISE

0.80 MT | ISA

ALT	KTAS OAT (°C)		GROSS WEIGHT – 1000 LB 78	74	70	66	62	58	54	50	46	42
45,000		MT	*****	*****	*****	*****	0.8	0.8	0.8	0.8	0.8	0.8
	458.9	KCAS	*****	*****	*****	*****	216	216	216	216	216	216
		FF	*****	*****	*****	*****	2754	2600	2459	2329	2212	2127
	-56.5	NAM / LB	*****	*****	*****	*****	0.1[illegible]66	0.1765	0.1866	0.197	0.2074	0.2157
25,000		MT	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	481.6	KCAS	338	338	338	338	338	338	338	338	338	338
		FF	4626	4582	4543	4509	4480	4451	4426	4406	4390	4374
	-34.5	NAM / LB	0.1041	0.1051	0.106	0.1068	0.1075	0.1082	0.1088	0.1093	0.1097	0.1101

Weight / Altitude / Fuel Consumption Relationship

TAS +/- WIND COMPONENT = GROUND SPEED

Trip time is governed by the speed of the aircraft over the ground. This speed is directly related to the winds at altitude.

The winds aloft on any given day may put a destination airport out of reach.

RECAP

- Optimum cruising altitude is a function of weight. The higher we fly, the less fuel we consume.

- Winds aloft affect ground speed. This in turn affects trip time, fuel requirements, and the feasibility of some trips.

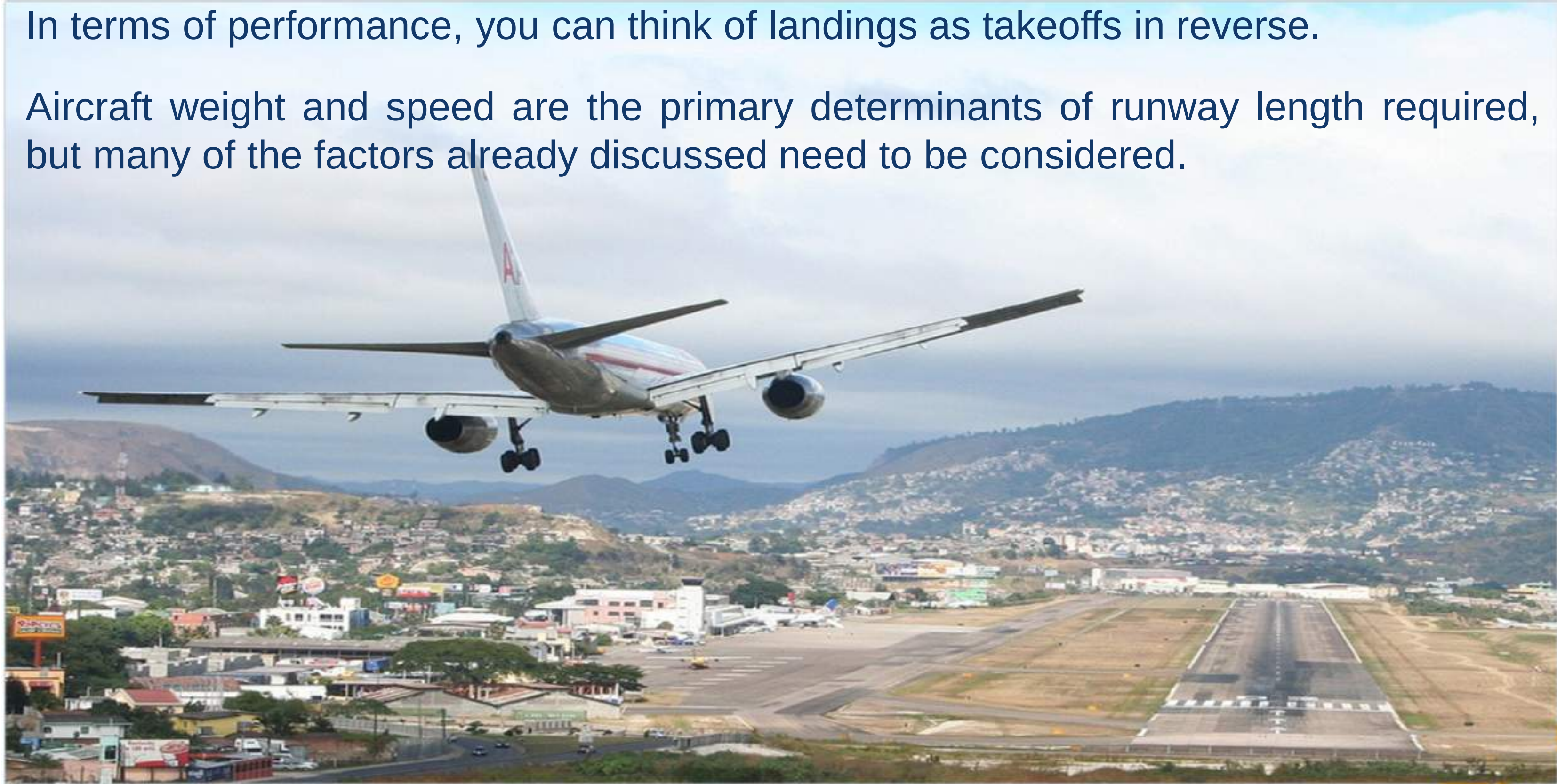
- Regulatory and special airspace requirements may affect routing and altitude selections. Both can have a negative impact on range.

  For example: RVSM, ADS-B/C, NAT HLA

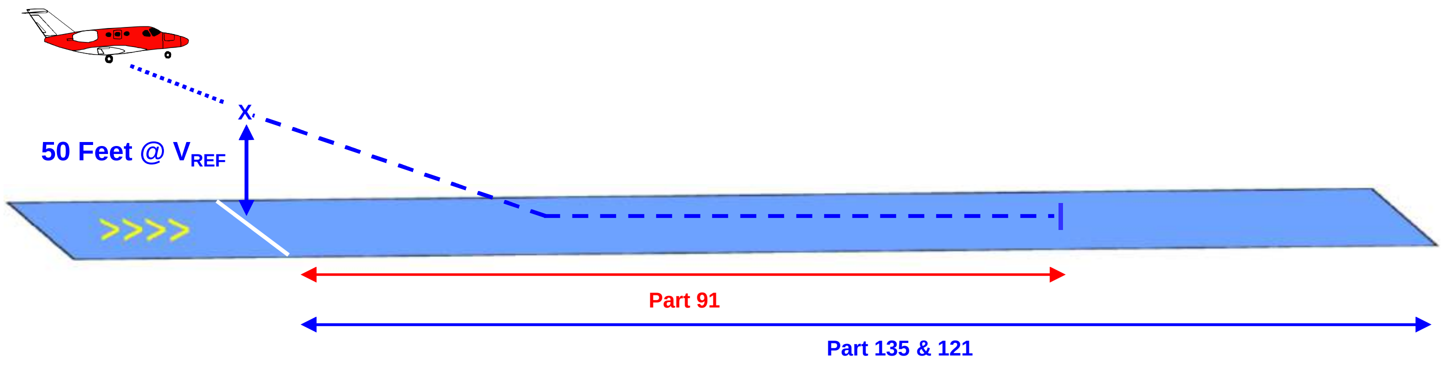

LANDING PERFORMANCE

In terms of performance, you can think of landings as takeoffs in reverse.

Aircraft weight and speed are the primary determinants of runway length required, but many of the factors already discussed need to be considered.

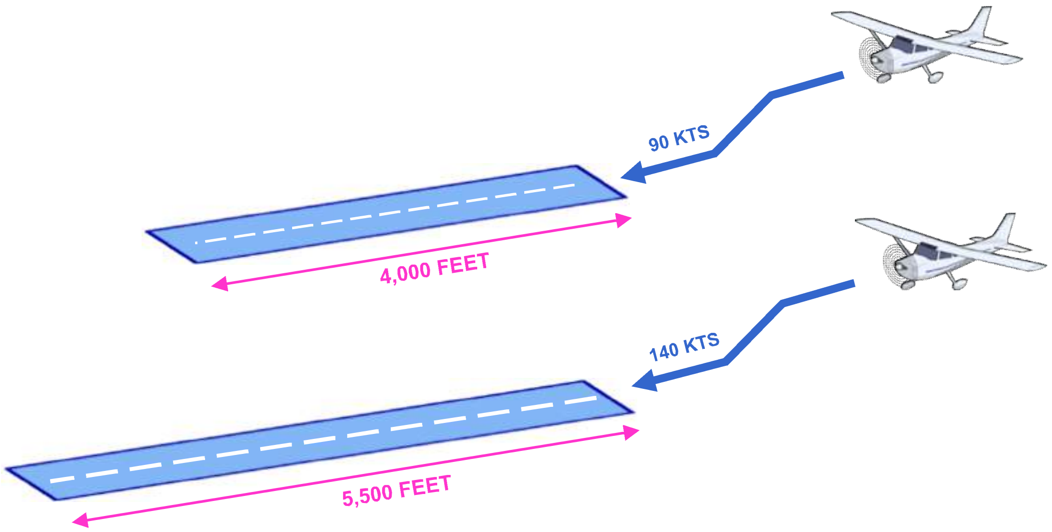


REGULATORY REQUIREMENTS



Operations under one set of rules or another can be the difference between being able to do a trip or not.

TEMPERATURE - PRESSURE - WIND



Lower air density and tail winds will result in the aircraft traveling faster over the ground. Longer stopping distances or lower weights will be required.

G450 Landing Field Length Table: Anti-Skid System Operative - Flaps 39° AFM 5.11

CAUTION: THE G450 MAXIMUM LANDING WEIGHT IS 66,000 LB (29,937 KG), UNLESS RESTRICTED BY CLIMB REQUIREMENTS.

NOTES:

1. ISA day, normal landing configuration.
2. For intended destination wet, multiply landing field lengths below by 1.15.
3. For unfactored landing distances, multiply field lengths below by 0.60.
4. Field lengths seen below are based on no wind or runway slope, but may be conservatively used with headwinds or uphill runway slopes.

Landing Gross Weight (Lb)	Intended Destination Dry Landing Field Length (Feet) For Airport Pressure Altitudes As Shown					
	Sea Level	2000 Feet	4000 Feet	6000 Feet	8000 Feet	10000 Feet
45,000	4340	4470	4620	4800	5020	5260
50,000	4580	4730	4910	5120	5370	5640
55,000	4830	5000	5200	5430	5720	6030
60,000	5100	5300	5510	5780	6090	6450
65,000	5380	5590	5830	6130	6480	6880
70,000	5670	5910	6170	6500	6900	7340
75,000	5970	6230	6530	6890	7340	7830


WET OR CONTAMINATED RUNWAYS
Stopping distances increase considerably when landing on wet pavement
or when the runway is covered with some form of contaminant.

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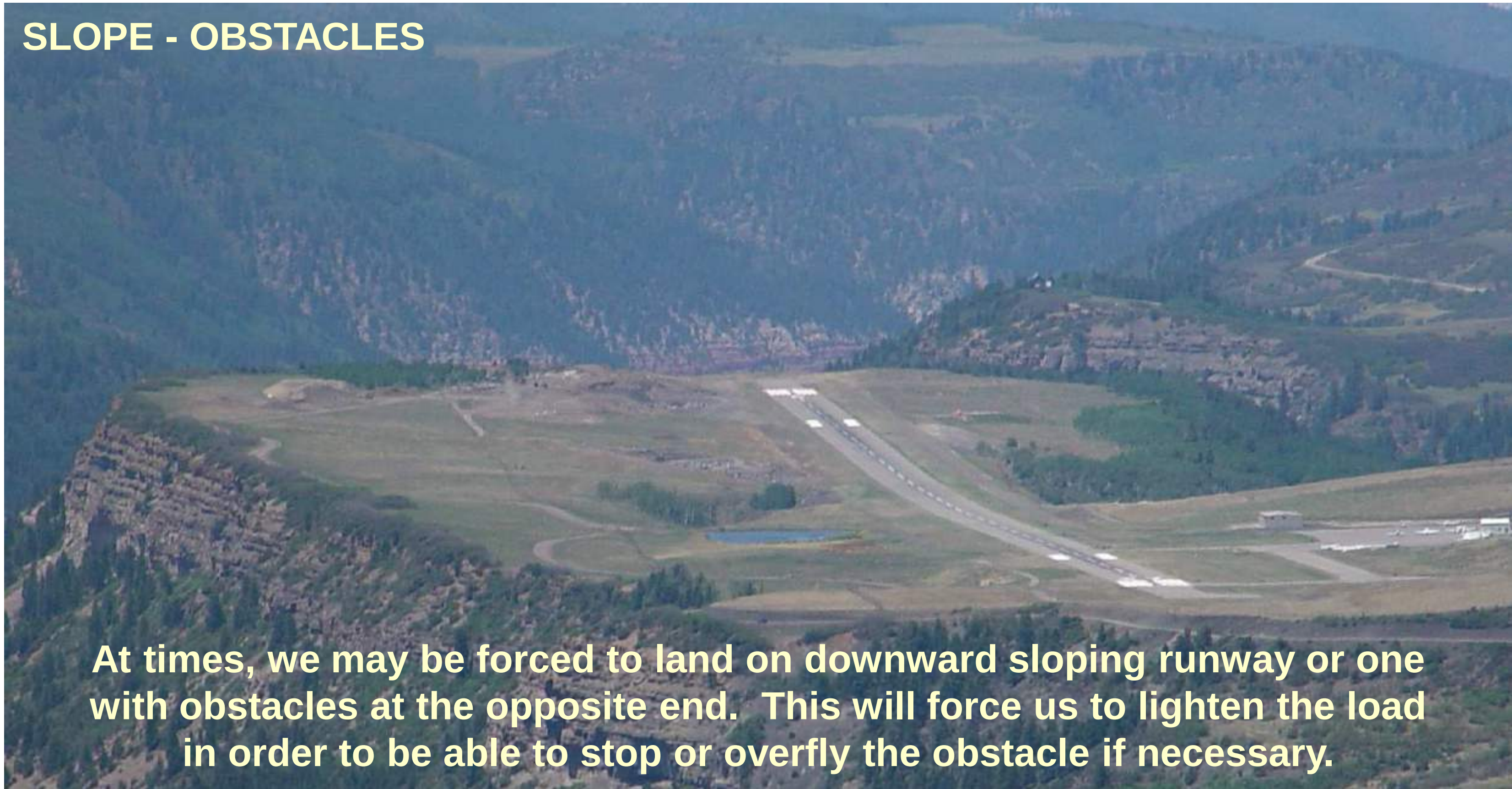
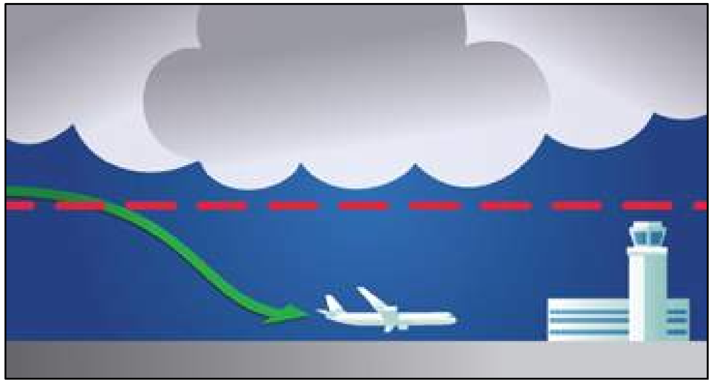
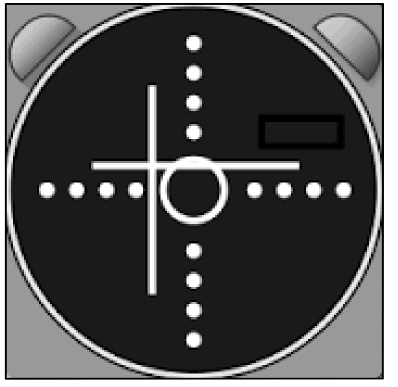
SLOPE - OBSTACLES



At times, we may be forced to land on downward sloping runway or one with obstacles at the opposite end. This will force us to lighten the load in order to be able to stop or overfly the obstacle if necessary.

APPROACHES AND VISIBILITY

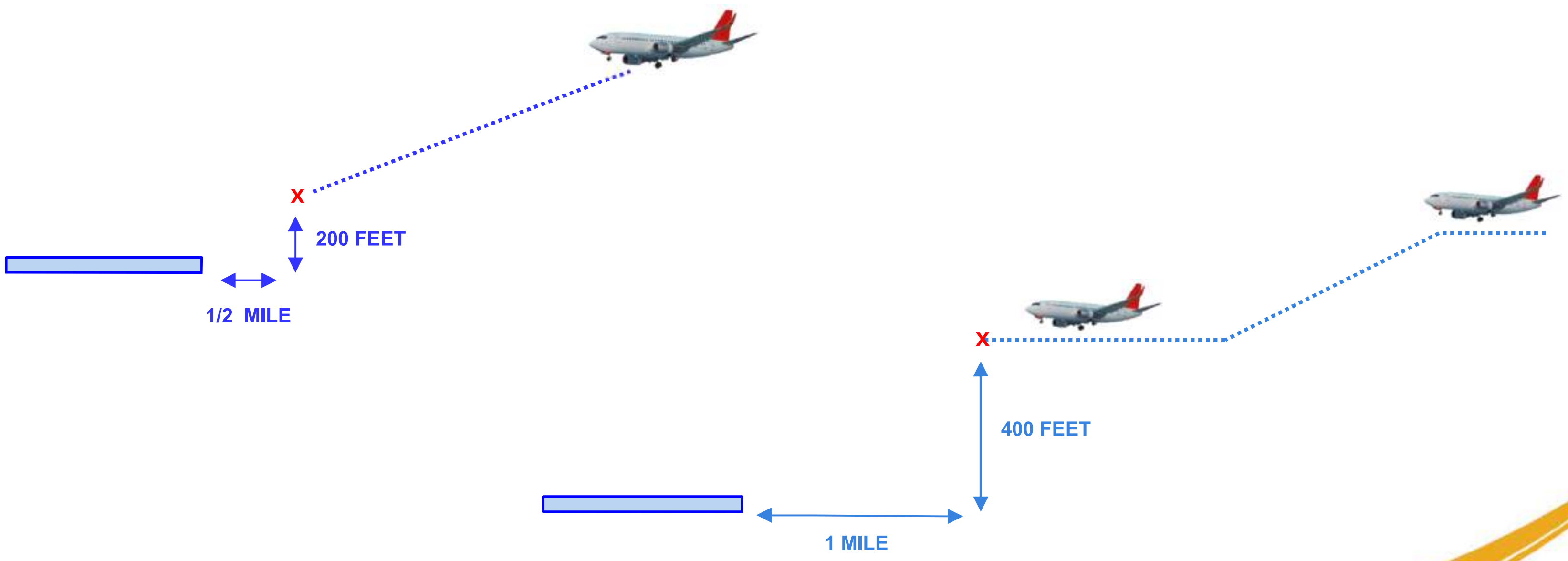




Instrument approaches are procedures which make use of electronic signals to guide an airplane towards a runway.

Once near, the pilot transitions from instrument to visual flight in order to land.

Some approaches will guide airplanes very close to the runway allowing for low visibility landings while others lessen our chances of success.



RECAP

- As with takeoff, weight and speed dictate the length of runway necessary.
- Tail winds, hot temperatures and/or low atmospheric pressure increase the length of runway required or force a reduction in landing weight.
- Wet or contaminated runways are detrimental to landing performance to the point where they can make a trip inadvisable.
- Beyond performance, the approaches available at an airport and prevailing visibility can have a significant impact on the success of a trip.

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Do you see an airport anywhere?
Would you continue descending?