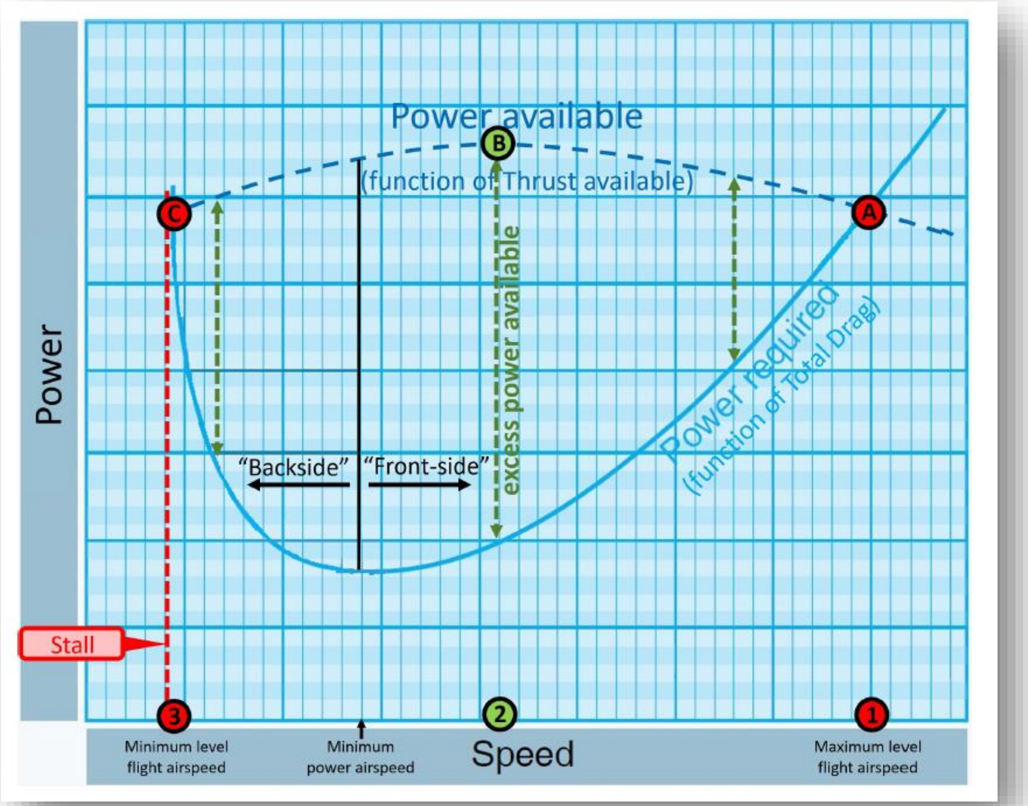
The National FAA Safety Team Presents

Federal Aviation Administration

Topic of the Month—April

Energy Management—Part 1 (of 2)



Presented to:	Safety Minded Aviators, Everywhere…
By:	Stephen Bateman, CFI, Chocks Away Aviation, LLC
Date:	Tuesday 16th April 2024

Produced by:
The National FAA Safety Team (FAASTeam)

Welcome

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FLYING CLUBS RUSTY PILOTS FLIGHT TRAINING HIG

› Flying Clubs › Club Connector Newsletter

FLYING CLUB CONNECTOR NEWSLETTER

Your source for the latest news on flying clubs all over the country. AOPA's research has shown us that flying club leaders are hungry to learn more about the practical experiences of other clubs. So, we have created this monthly e-newsletter.

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ARTICLES BY TOPIC

NEWS FROM HQ	QUESTION OF THE MONTH	CLUB SPOTLIGHT
AIRCRAFT SPOTLIGHT	SAFETY	EVENT SPOTLIGHT

CLUB CONNECTOR ARTICLES

NARROW RESULTS

SAFETY

NARROW RESULTS

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CLUB CONNECTOR | MARCH 15, 2024

Safety Topic of the Month: Pilot Proficiency and WINGS

In last month's safety section, we looked at getting the plane and club members ready for the coming flying season. This month, we'll take it further by revisiting the importance of pilot proficiency and how the FAA's general aviation pilot proficiency program, WINGS, helps us organize our training for ever-increasing skill and knowledge. Don't do WINGS? Well, you are missing out in so many ways, including the possibility of insurance discounts.

GO TO ARTICLE

CLUB CONNECTOR | FEBRUARY 18, 2024

Safety Topic of the Month: Preflight in a Box

In this safety section, we'll continue the general theme of February's Club Connector newsletter—getting ready for flying season—and will take a dive into preflight inspections, for both aircraft and pilots. We'll also introduce the latest FAASTeam large-scale community outreach efforts of "Preflight-in-a-Box" and "First Responders Training". Hopefully, more attention to the first one will involve less reliance on the second.

GO TO ARTICLE

CLUB CONNECTOR | JANUARY 21, 2024

Safety Topic of the Month: Human Performance and Safety Culture

In this month's safety section, we will take a slightly fresh look at the topic of Human Performance and how it plays a vital ro in everything we do as aviators. Based on decades of data, we will speculate that the majority of general aviation accidents are not accidental at all. In fact, both the number and classification of these events are highly predictable. Does this worry you? We hope so, because then we can collectively do something about it!

GO TO ARTICLE

Energy Management – In Two Parts (April and May TOM)

- **Part-1: Some background and theory**

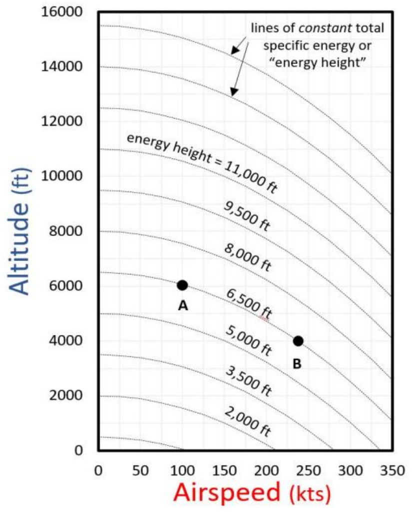
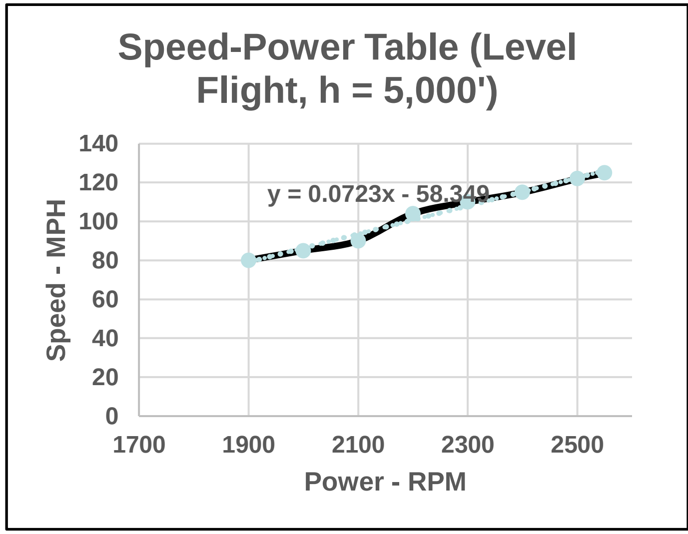


Figure 4-6. The altitude-speed "map" showing lines of constant energy height.

- **Part 2: Putting it together in real world situations**



What, Why, When

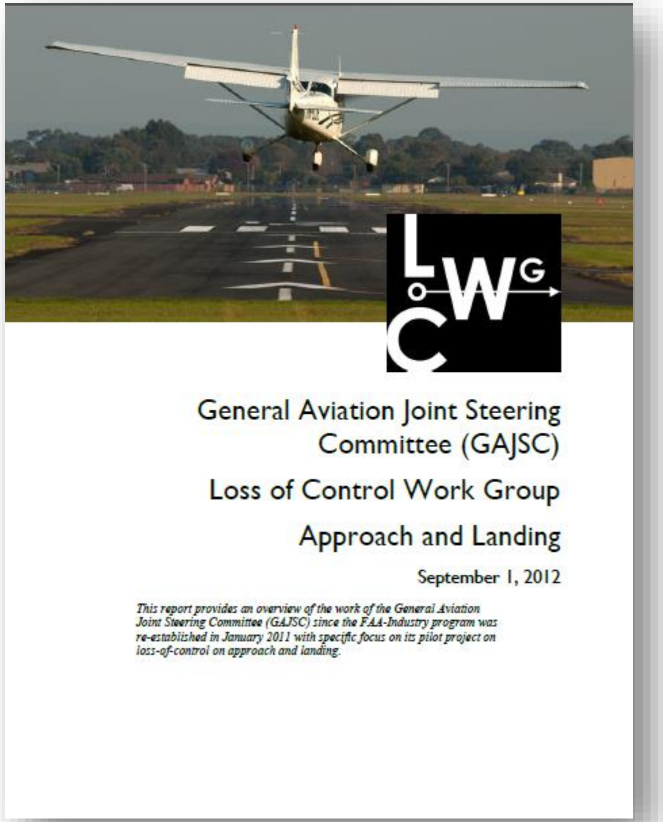
- **What**
  - Understand the terminology of aircraft energy
  - Appreciate and manage aircraft total energy and energy distribution
  - The true role of energy controls: Throttle and Elevator
  - Pilots are managers of energy

- **Why**
  - Mismanagement of aircraft energy contributes to loss of control situations

- **When**
  - All flights, from start to shut down, involve energy management and exchange
  - Think “energy” when training, practicing and “normal” flying
  - Energy management is what flying is all about

Overview

- **Aircraft Performance Awareness**
  - GAJSC: Many aircraft incidents are the results of a lack of understanding of energy management:
    - Hard landings
    - Stall on take-off
    - Stall-spin situations
    - Slow flight/moose turns
    - High DA operations
    - “Trying” aerobatics
- **Aircraft Energy Terminology**
  - Total energy
  - Energy exchange
  - Adding energy
- **Managing Energy**
- **Solving Energy Problems**
- **Energy Scenarios**

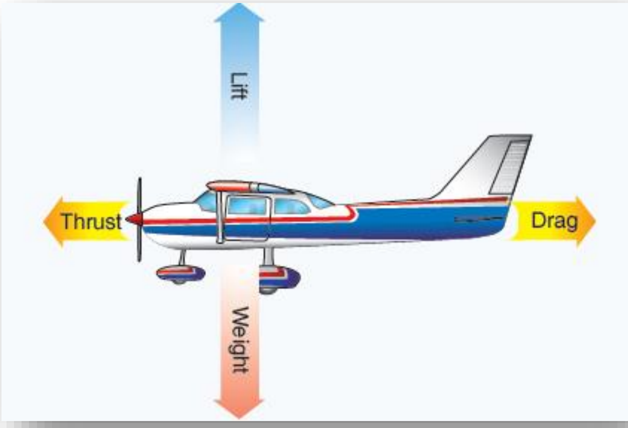

General Aviation Joint Steering Committee (GAJSC)
Loss of Control Work Group
Approach and Landing
September 1, 2012

This report provides an overview of the work of the General Aviation Joint Steering Committee (GAJSC) since the FAA-Industry program was re-established in January 2011 with specific focus on its pilot project on loss-of-control on approach and landing.

***GAJSC – General Aviation Joint Safety Committee**

Terms and Terminology

- **Force:**
  - A force is an influence that causes an object to change its velocity (to accelerate)
  - In constant-speed flight, force of Thrust = force of Drag
  - No net force, so no acceleration



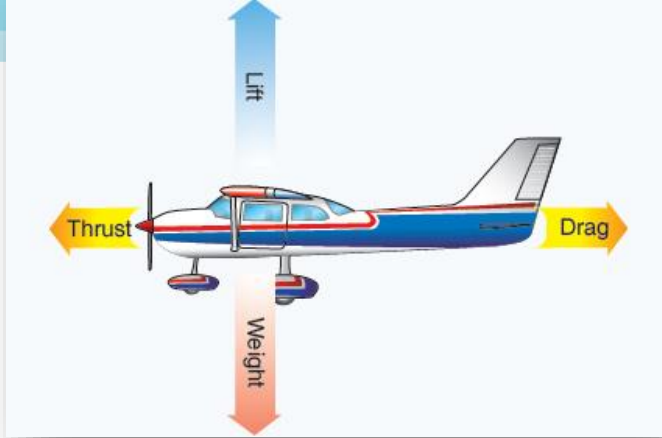
- **Energy:**
  - A fundamental entity of nature that is transferred between parts of a system in the production of physical change within the system, and usually regarded as *the capacity* for doing work
  - As a general concept: the ability or *capacity* to produce an effect
  - Unit of energy is the Joule (other units…Erg…)

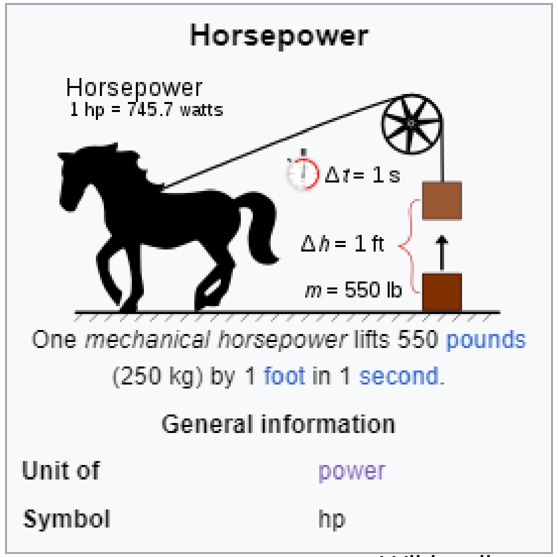
•https://www.merriam-webster.com/dictionary/energy

•https://www.oed.com/dictionary/energy_n?

Terms and Terminology-1

- **Chemical Energy:**
  - Energy stored in fuel (100LL, battery…)
  - Is available to “do something” by converting to another form
- **Mass:**
  - Traditionally, “the quantity of matter in a body”
  - (Different definition in quantum mechanics, but this works for us)
  - Unit is Kilogram
- **Power:**
  - Power is the amount of energy transferred or converted per unit time…it is the rate of energy usage
  - Measured in Watts. 1 Watt = 1Joule per second
  - Other unit—horsepower. The power required to raise a mass of 155 pounds a distance of 1 foot, in one second
  - 1 HP = 746 Watts



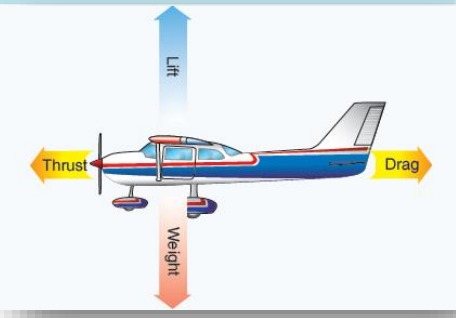


Wikipedia

•https://www.merriam-webster.com/dictionary/energy

•https://www.oed.com/dictionary/energy_n?

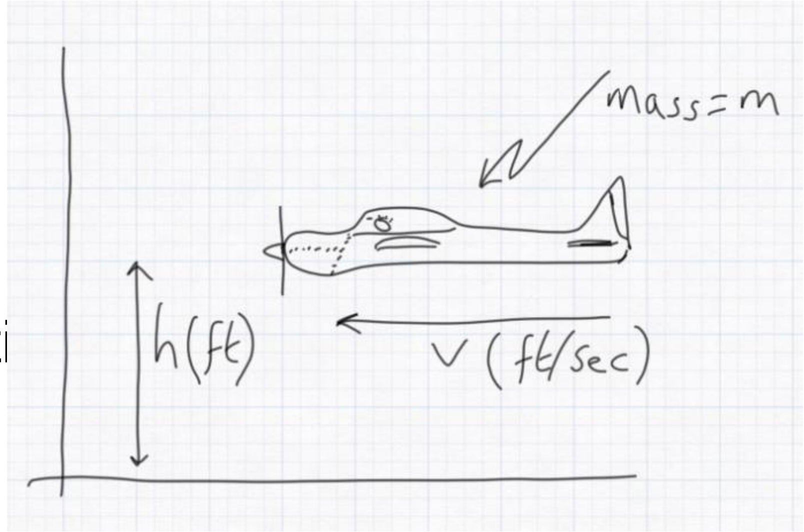
Terms and Terminology-2



- **Power and Thrust:**
  - Power converts stored fuel energy into crankshaft rotation
  - Crankshaft turns the propeller that creates a forward acting force = thrust
- **In level flight:**
  - T=D: Unaccelerated flight
  - Increase thrust. $T_2 > D_1$:
    - Aircraft accelerates from V_1 to V_2
    - Drag increases to D_2, where $D_2 = T_2$
    - Back to unaccelerated flight, but at V_2
  - Decrease thrust. $T_2 < D_1$:
  - Aircraft decelerates from V_1 to V_2
    - Drag reduces to D_2, where $D_2 = T_2$
    - Back to unaccelerated flight, but at V_2
- **Thrust (force) produces an acceleration**
  - Rate of change of velocity, so rate of change of kinetic energy…

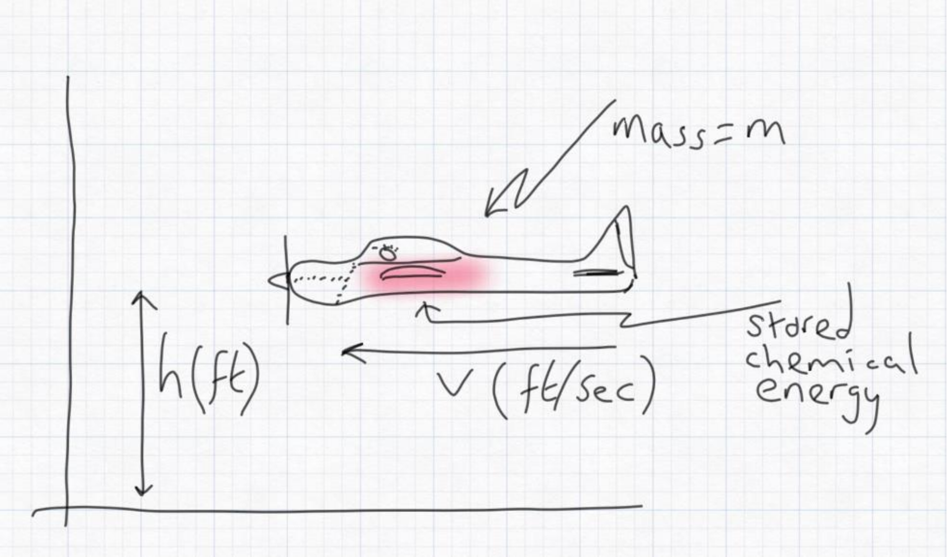
Aircraft (Mechanical) Energy

- **Kinetic Energy - Airspeed**
  - Associated with motion through the air
  - KE = ½ m V^2
    - m = mass
    - V = velocity
- **Potential Energy - Altitude**
  - Potential energy due to height – the potential of gravity acti mass
  - PE = m g h
    - m = mass
    - g = gravitational acceleration
    - h = height
- **Total Energy = KE + PE**



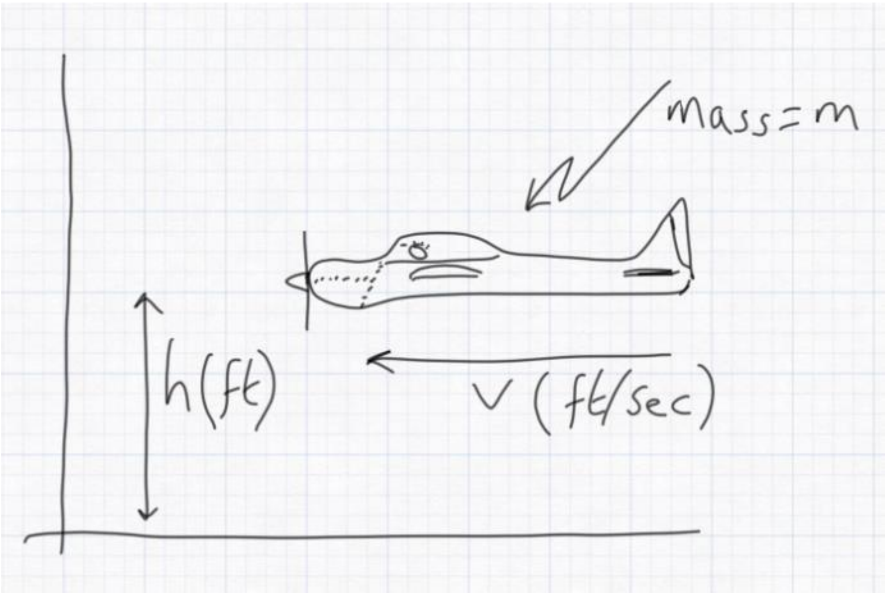
Aircraft Energy Fundamentals:

- **In a closed system, energy cannot be arbitrarily created or destroyed**
- **Fuel (chemical or electrical energy) converts to engine power (energy rate)**
- **Engine power converts to thrust via the propeller**
- **Power is the rate of energy expended (1 W=1 J/s)**
- **Power has a per-unit-time component (rate)**
- **Thrust is a force**
- **Energy can be (and is) converted from one form to another…**
- **With no change in thrust:**
  - Can convert KE to PE (an aircraft increasing in altitude will slow down)
  - Can convert PE to KE (a descending aircraft will increase in speed)
- **For aircraft in flight, throttle adds power**
  - Rate of use of energy converted from stored chemical energy
  - Can be “used” in various ways…



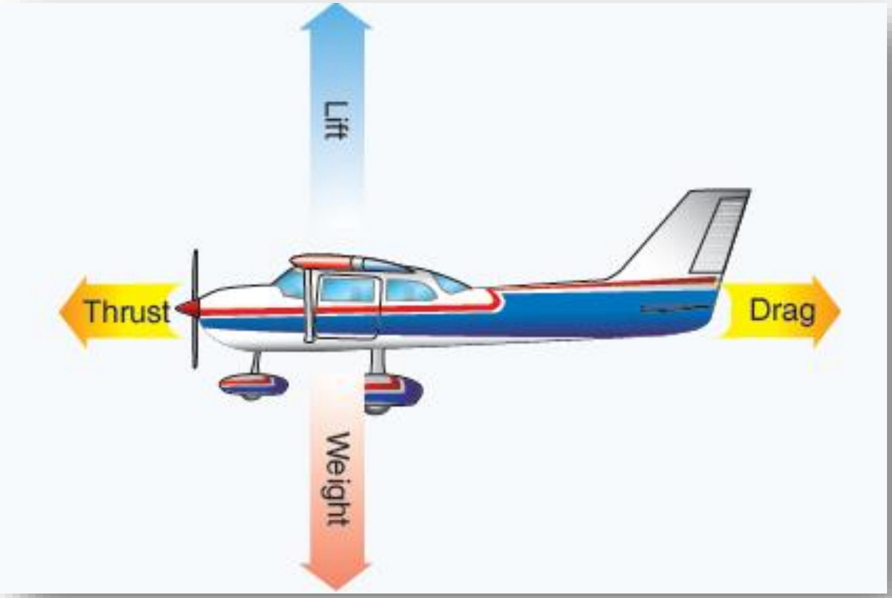
Aircraft Energy Equation - 1

- **Once in the air…level, a/c has stored energy**
- **Combination of altitude and airspeed gives the total system (mechanical) energy**
- **Increasing power adds energy (T > D)**
- **Can be used to go faster, to climb or both**
- **We decide…through control inputs**
- **We could:**
  - Climb at a constant airspeed (gain altitude, PE)
  - Stay level and accelerate (gain airspeed, KE)

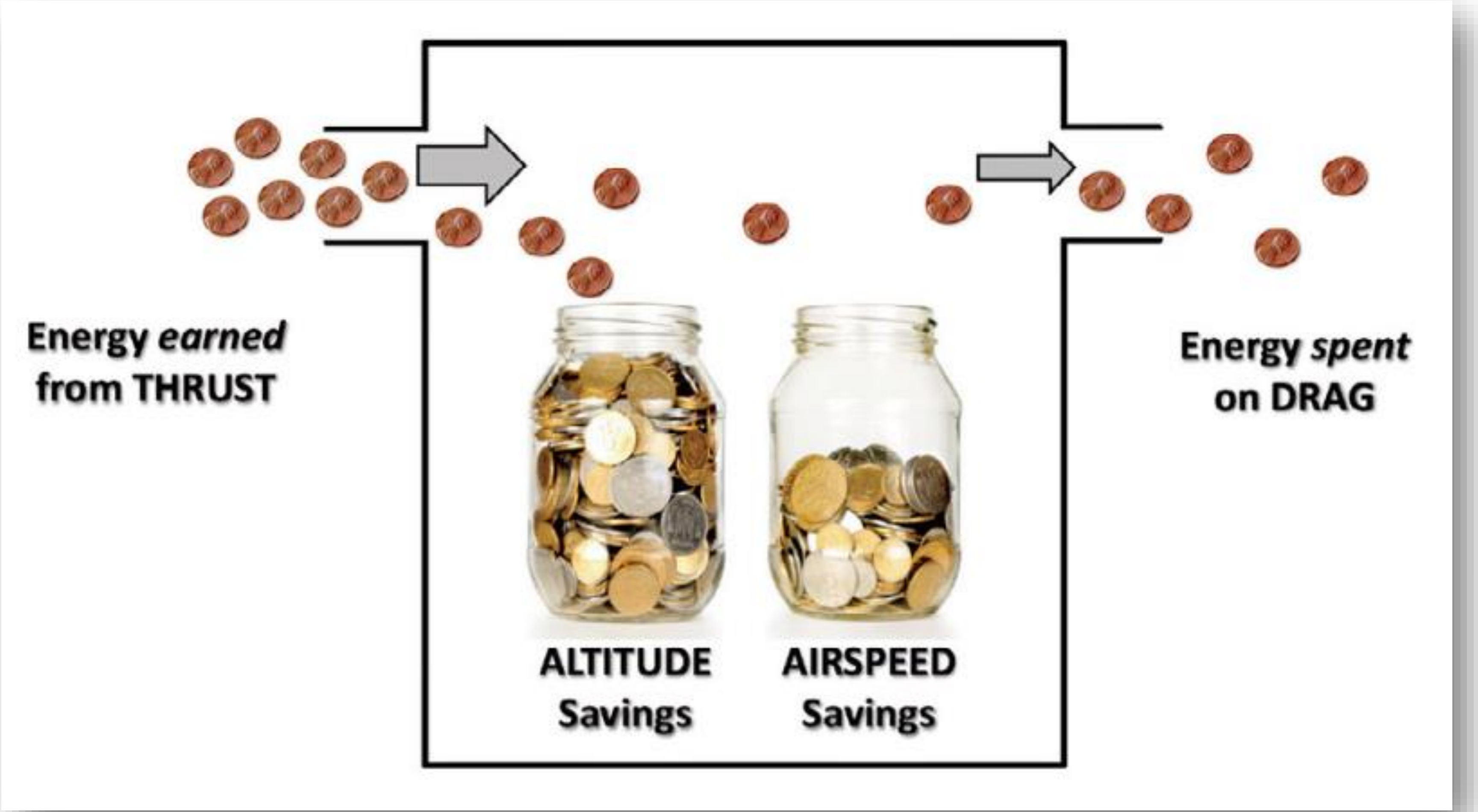


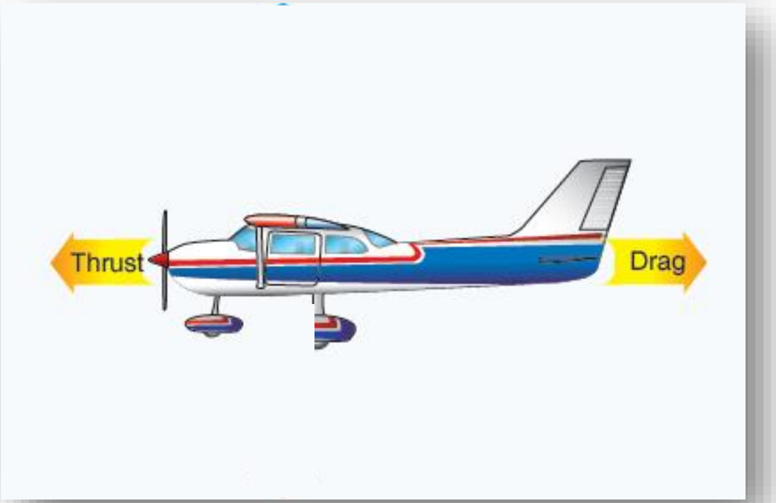
Aircraft Energy Equation - 2

- **Once in the air…level, has stored energy**
- **Combination of altitude and airspeed gives the system (mechanical) energy**
- **Decreasing power removes energy (T < D)**
- **Can be "used" to go slower, to descend or both**
- **We decide… through control inputs**
- **We could:**
  - Stay level and slow down (lose KE)
  - Descend at constant airspeed (lose PE)



Energy Transactions





Energy Transactions

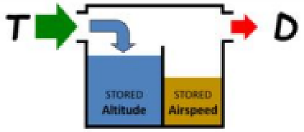
Energy Transaction Examples		Net Energy Change (T – D)	Change in Stored Energy		Resulting Aircraft Condition
			Altitude	Airspeed	
A		> 0	Increase	No change	Climb at constant airspeed

Figure 4-1 A-F. *Examples of typical energy transactions.*

Energy Transactions

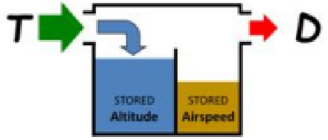
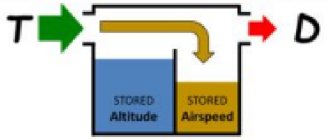
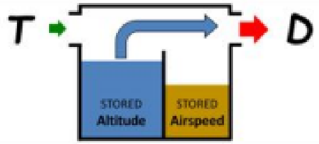
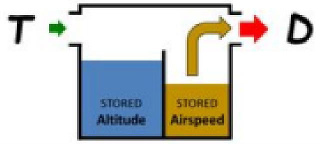
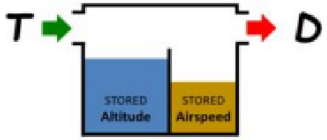
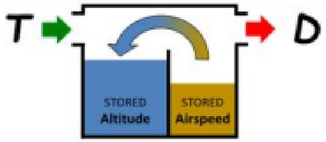
Energy Transaction Examples		Net Energy Change (T – D)	Change in Stored Energy Altitude	Change in Stored Energy Airspeed	Resulting Aircraft Condition
A		> 0	Increase	No change	Climb at constant airspeed
B		> 0	No change	Increase	Acceleration at constant altitude
C		< 0	Decrease	No change	Descent at constant airspeed
D		< 0	No change	Decrease	Deceleration at constant altitude
E		= 0	No change	No change	Constant altitude and airspeed
F		= 0	Increase	Decrease	Climb and deceleration

Figure 4-1 A-F. *Examples of typical energy transactions.*

Energy Balance

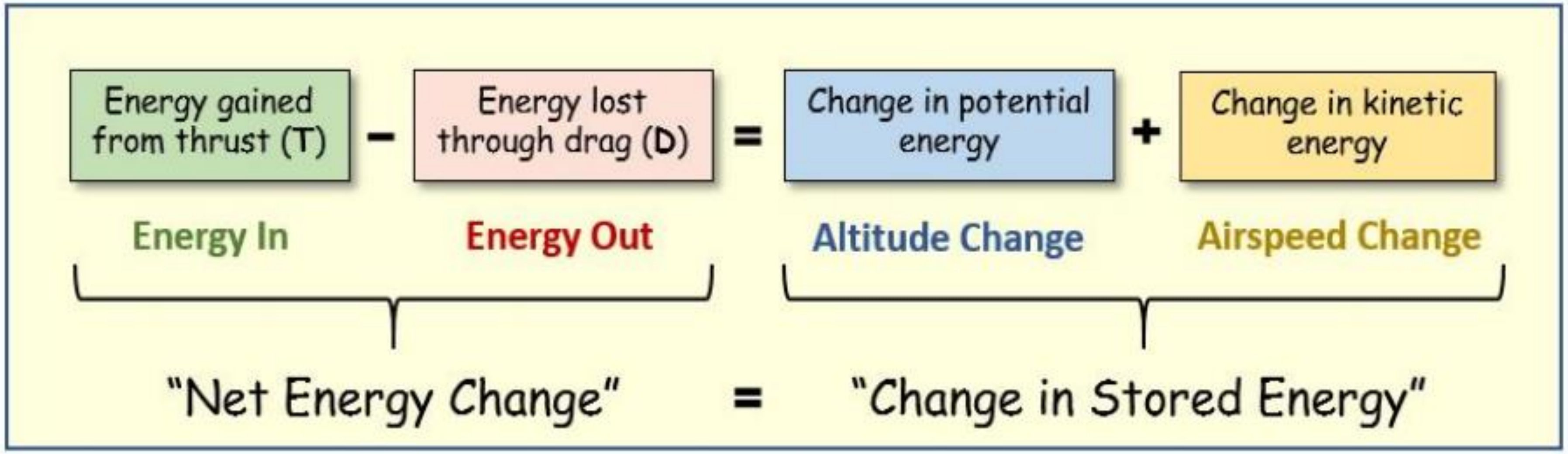


Figure 4-2. *The energy balance equation.*

- **LHS is energy flow - thrust and drag**
- **RHS is the balancing change in energy distribution**
- **Pilot controls the distribution by throttle and elevator**

- **"Pitch for airspeed, power for altitude"**

Throttle and Elevator

- **Total energy is a function of T and D…**
- **Drag changes (exponentially) with airspeed, but the most "instantaneous" changes in total energy are via thrust (and hence throttle)**
- **Throttle influences the thrust/drag relationship**
- **T > D…an increase in total energy (distributed between KE and PE)**
- **T < D…a decrease in total energy (distributed between KE and PE)**
- **We set the throttle to match the combined requirements of airspeed and vertical flight path (level, climb, descent)**
- **Throttle is NOT just a speed control or climb control…it is a FLIGHT CONTROL!**
- **We all (should) know this from go arounds…**
  - Push the throttle, push the stick to convert the extra energy into airspeed before climbing
- **Think of the throttle as a *total energy controller***

Throttle and Elevator

- **The elevator *distributes* (changes in) total energy between airspeed and vertical flight path, via pitch attitude**
- **We set the pitch attitude to match the combined requirements of airspeed and vertical flight path (level, climb, descent)**
- **The elevator is NOT an up/down control…it is a FLIGHT CONTROL!**
- **We all (should) know this from go arounds…**
  - Push the throttle, push the stick to convert the extra energy into airspeed, then pitch for climb
- **Think of the elevator as an *energy distribution controller***

- ***Throttle and elevator work together to control and allocate energy depending on the required flight profile***

Reservoir and Valve Analogy

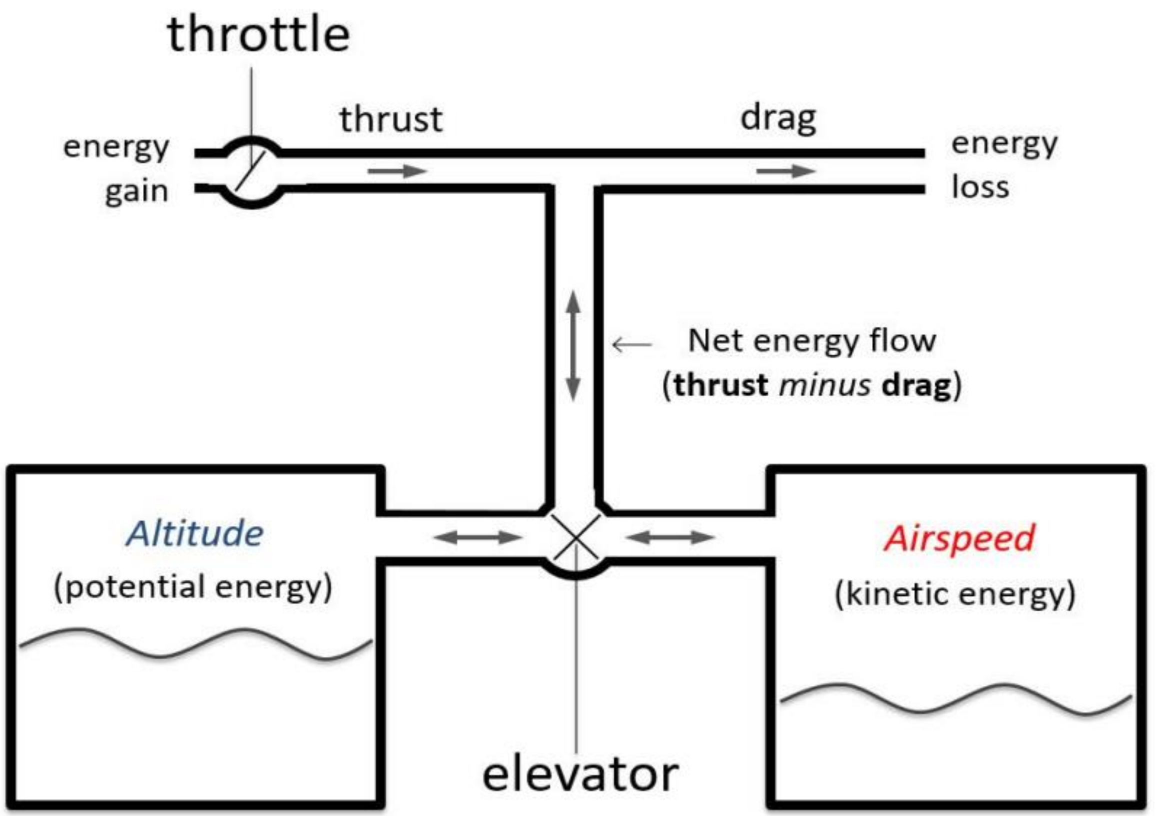


Figure 4-3. *The reservoir analogy illustrating the primary role of the throttle and elevator to manage the airplane's energy state.*

- **When T>D, energy increases**
- **When T<D, energy reduces**
- **Elevator allocates the difference between KE and PE reservoirs**
- **When T=D, total energy is constant & elevator exchanges energy between KE and PE reservoirs**

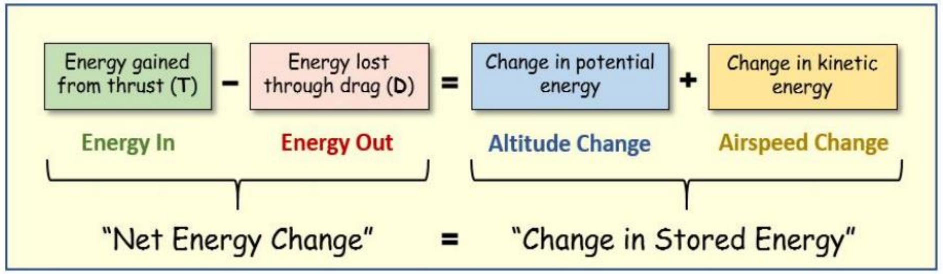


Figure 4-2. *The energy balance equation.*

Throttle

Elevator

Aircraft Climb Energy

An aircraft climbs (gains altitude, and so PE)…

1. **…by using *excess available power* compared with that required for level flight**
2. **…by trading speed (KE) for PE (“zoom climb”)**

- **Climbing is important (duh):**
  - Climb over an obstruction rather than hitting it
  - Climb to better weather conditions and/or more favorable winds
  - Climb to lower air density and so less drag and higher true air speed (TAS)
- **Best rate of climb (V_y) is important to get to altitude quickly**
- **Best angle of climb (V_x) is important to get to altitude in the shortest distance**

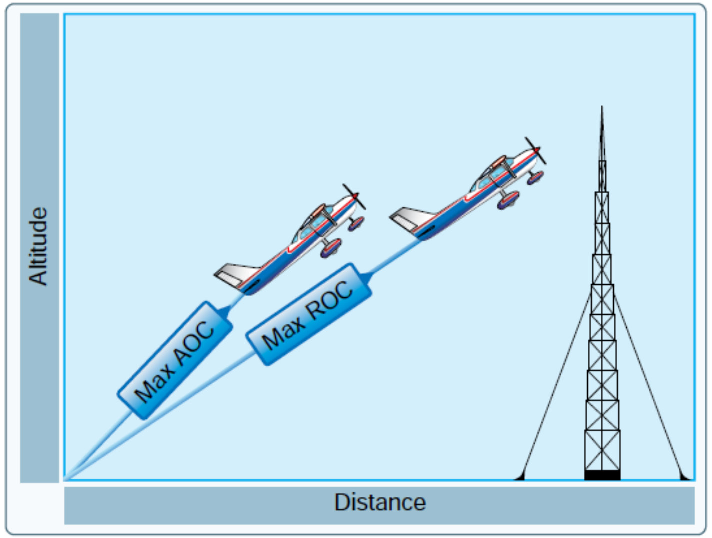
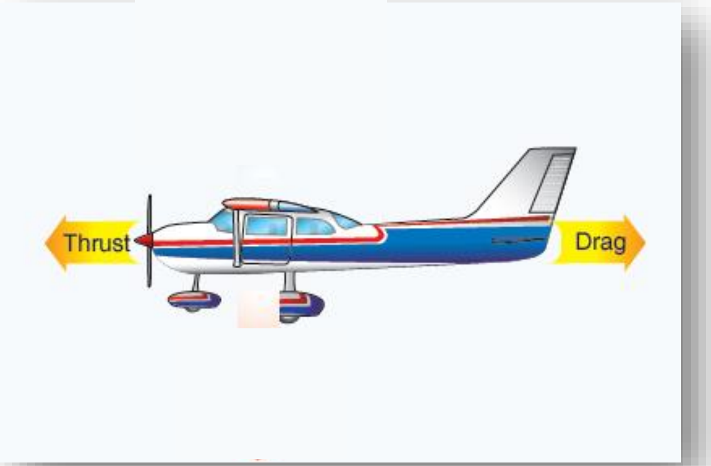
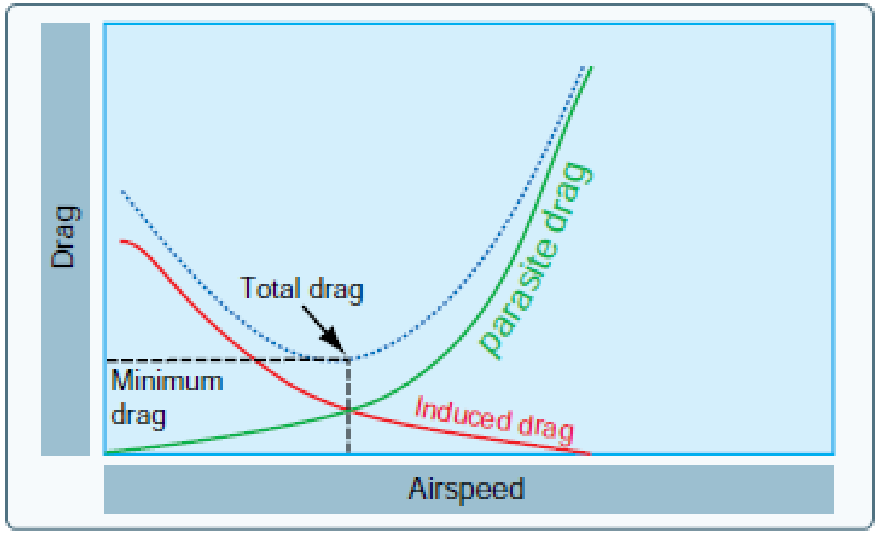


Figure 11-7. *Maximum angle of climb (AOC) versus maximum rate of climb (ROC).*

Drag

- **Drag-Speed Curve:**
  - Total drag is made up of many components
  - Simply, total drag = parasitic + induced drag
  - Parasitic drag (form, friction, interference…) $\alpha\ V^2$
  - Induced drag (by-product of lift generation) $\alpha\ 1/V^2$
  - Total drag curve has a minimum point
  - Airspeed at this point is $V_{(min\text{-}sink)}$
  - Not the same as $V_{(best\text{-}glide)}$ at $(L/D)_{max}$





•FAA PHAK

Figure 5-6. *Drag versus speed.*

Drag

- **At normal operational speeds, drag increases with the square of airspeed**
  - Double the speed, quadruple the drag

- **In straight and level flight:**
  - Increase thrust
  - Reduce AOA to remain in level flight
  - Aircraft speed increases…drag greatly increases…
  - When D = T, back in unaccelerated flight – equal forces
  - Up to a point where there is no available thrust left to overcome rapidly increasing drag
  - With full throttle, drag dictates the max. airspeed in level flight

- **Adding a bigger engine may give a few more knots…reducing drag will give far more…**
  - Bigger engine will increase *power available for climbing*

- **Drag dominates at high speeds, requiring large amounts of thrust to overcome**

Drag and Power Required

- **So…the total drag curve sets the limits on airspeed due to available power**
- **Rethinking this, we can draw a "power required" curve for an aircraft (in level flight)**

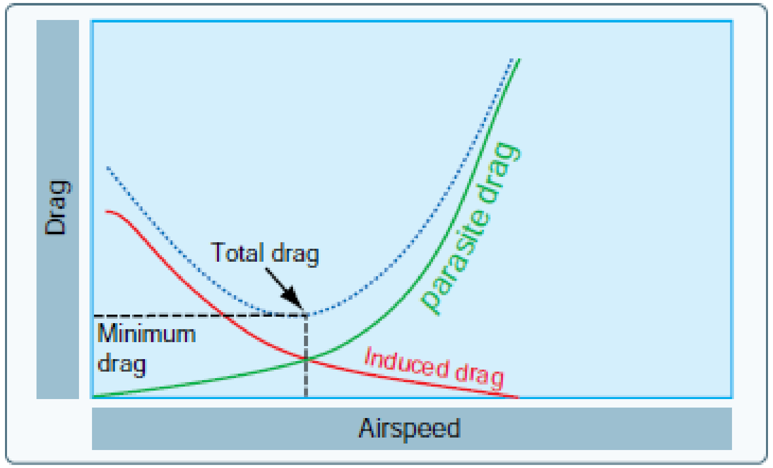
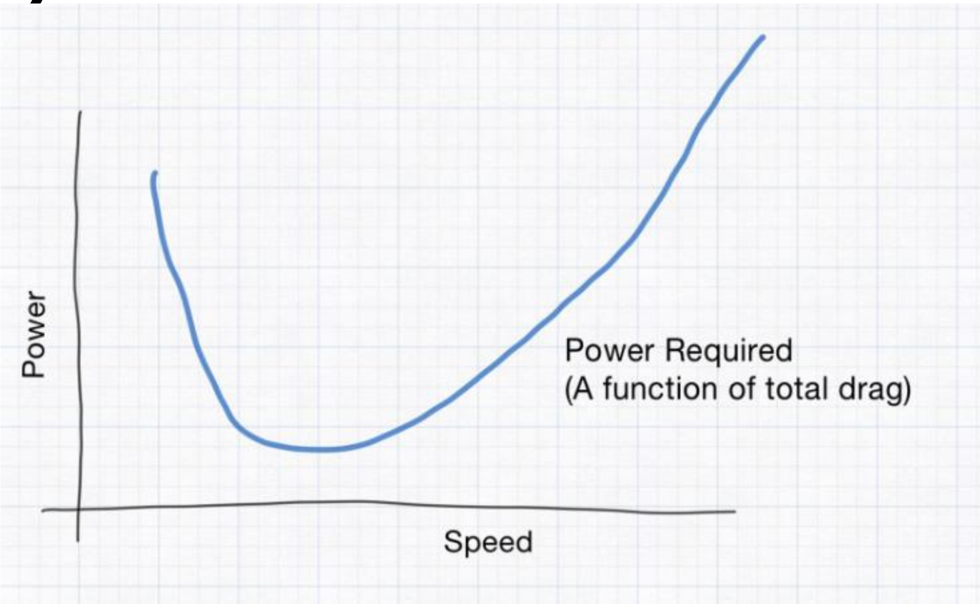


Figure 5-6. *Drag versus speed.*



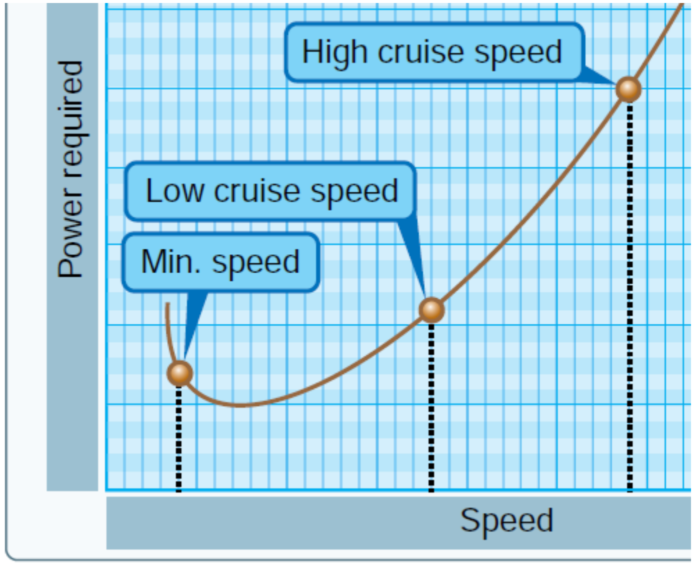


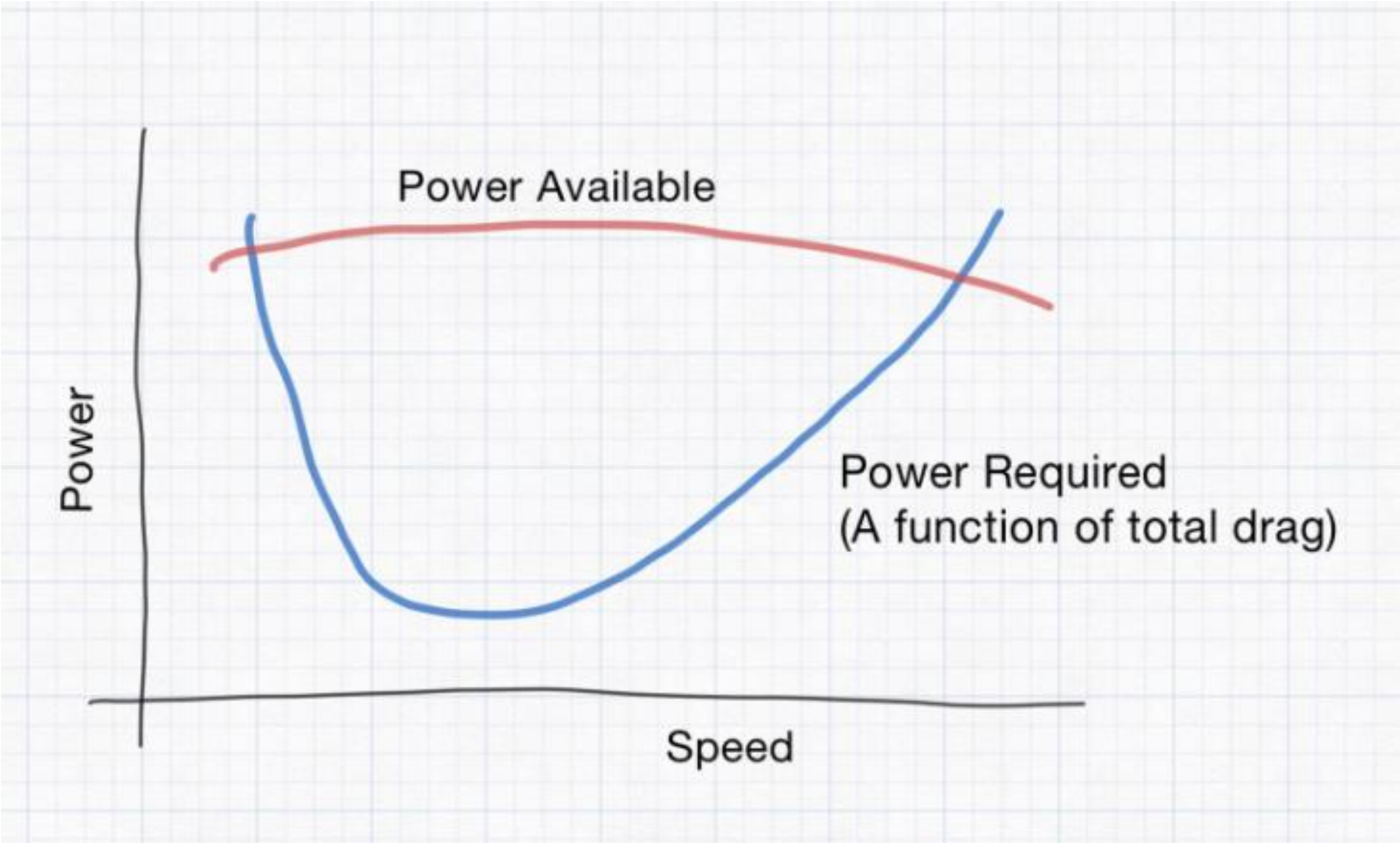
Figure 11-6. *Power versus speed.*

Drag and Power Required

- **For a given engine/propeller (thrust) capability, we can plot a "power available" vs. speed curve**

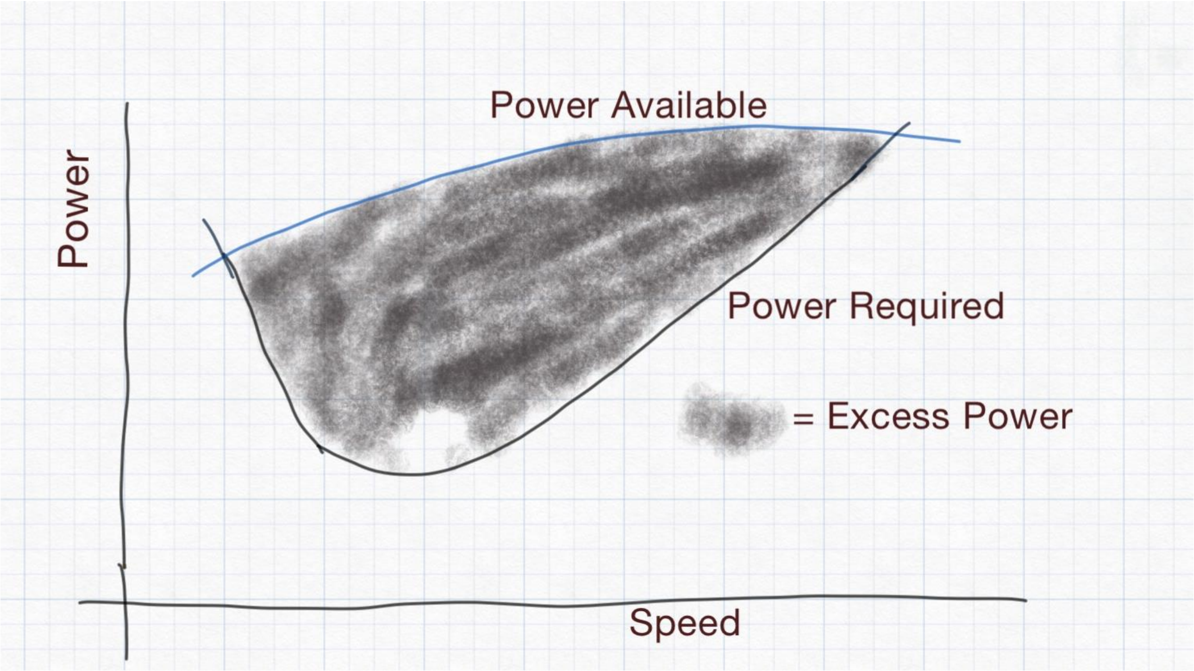
Drag and Power Required

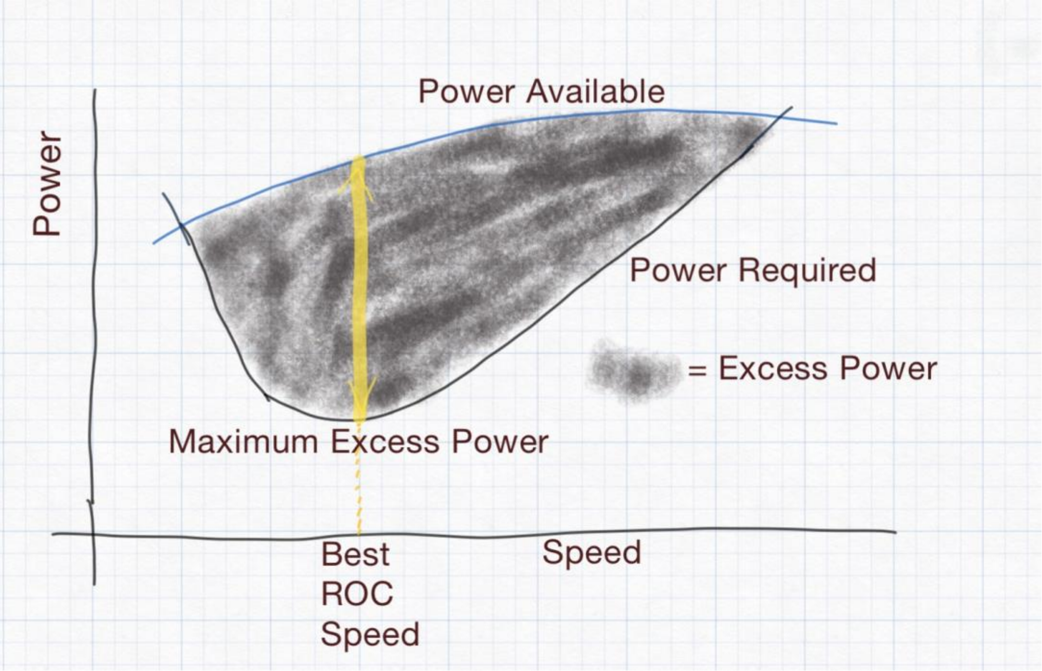
- **Combining "power available" with "power required" gives:**



Drag and Power Required

- “Excess power” is the difference between power required and power available
- Excess power at any speed, is the “climb capability” of the aircraft
- Climb rate (feet per minute) depends on excess power (power involves “per-time” units)
- Best rate of climb (V_y) occurs at the airspeed of maximum excess power
- (Best angle of climb occurs at the airspeed of maximum excess thrust)





Drag and Power Required

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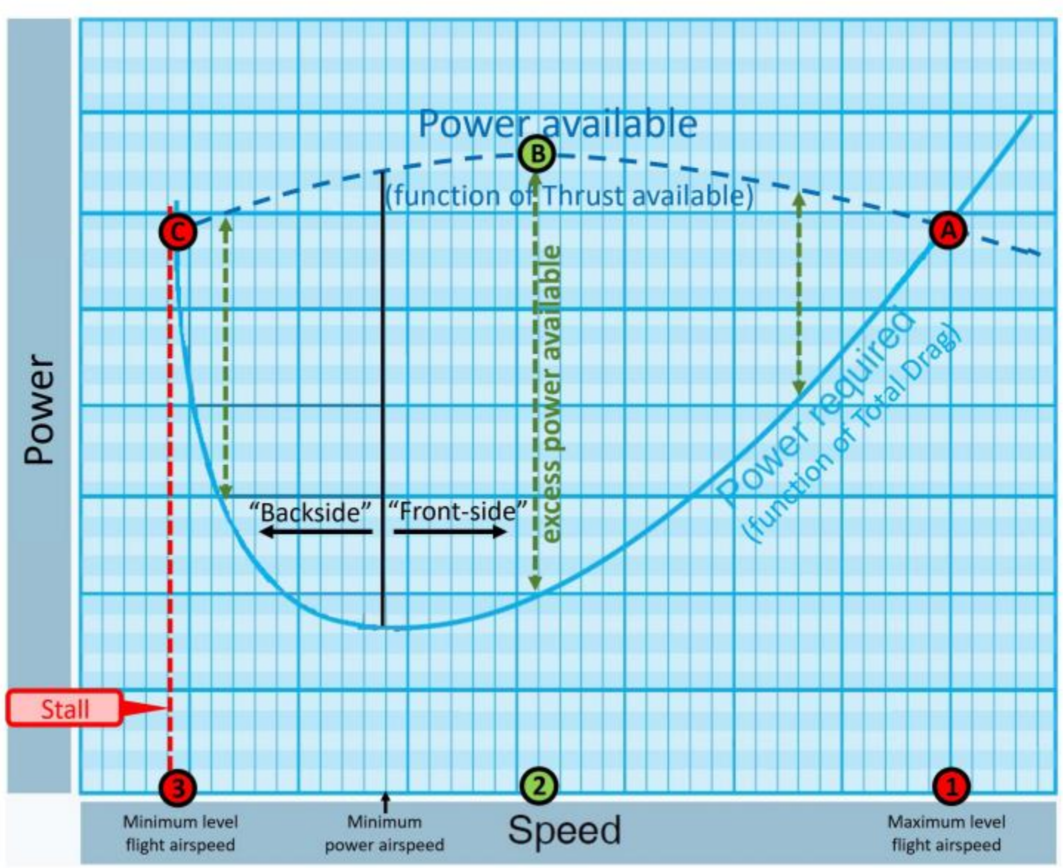


Figure 4-4. *The front side and backside of the power required curve, the power available curve, and the relative excess power available (power available - power required) at different speeds.*

- **Point A:**
  - Power available crosses power required at high speed end
  - No excess power available
  - Results in maximum level flight speed
- **Point B:**
  - Max difference between power available and power required = "maximum excess power"
  - Results in airspeed giving best ROC (V_Y)
- **"Back side-Front side":**
  - "Backside of the power curve"
  - Power required rises sharply at low speeds
  - For level flight, requires higher AoA = higher induced drag
  - More power required to fly slowly
- **Point C:**
  - Power available crosses power required at low speed end
  - No excess power available
  - Results in minimum level flight speed

Energy Exchange

- **Elevator as an energy exchanger (at constant power setting)**

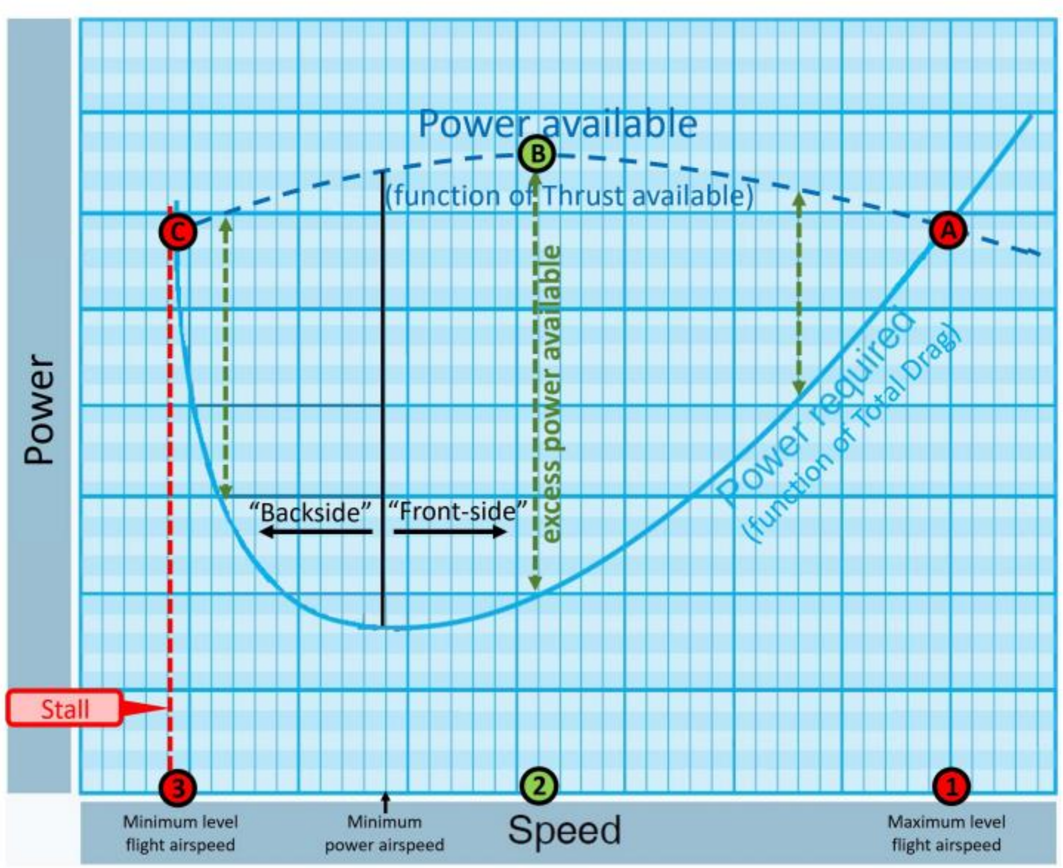


Figure 4-4. *The front side and backside of the power required curve, the power available curve, and the relative excess power available (power available - power required) at different speeds.*

- **Point A:**
  - Little to no excess power
  - Now pull back on stick (up elevator)
  - Starts to climb
  - A/c slows…moves down the speed axis from 1 towards 2
  - Total drag (power required) reduces, excess power increases
  - Power available for climb (or level turn at LF >1)
  - At point 2, max excess power exists and so a/c could climb at best rate, V_y
  - Will exchange KE for PE

- **Point C:**
  - Aircraft is flying level at minimum level flight speed
  - High AOA = high induced drag = high total drag
  - Push forward on stick (down elevator)
  - Starts to descend
  - A/c speeds up…moves up the speed axis from 3 towards 2
  - Total drag (power required) reduces, excess power increases
  - Power available for climb

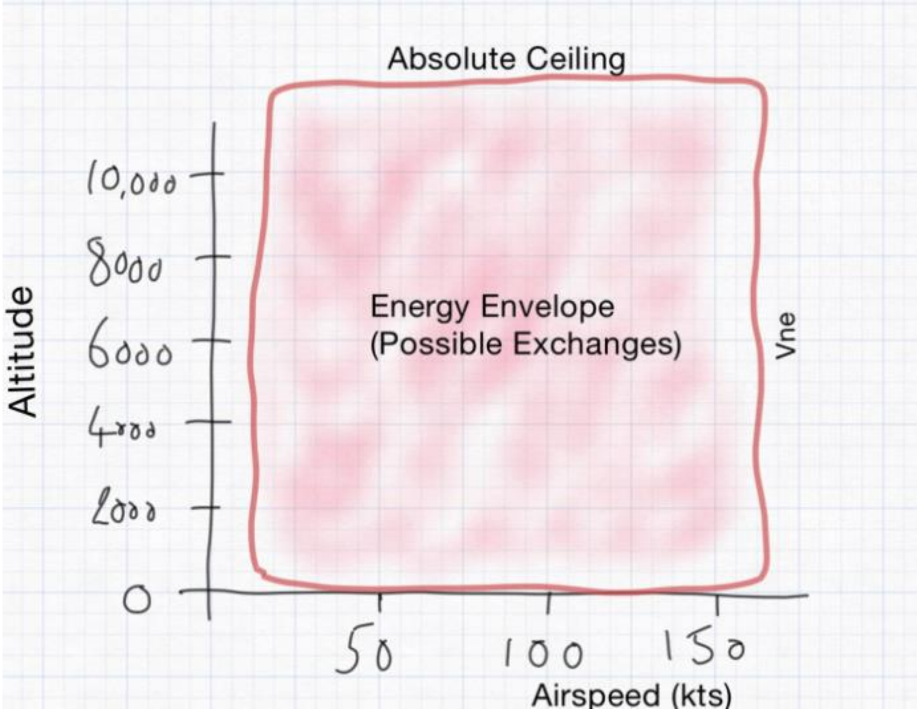
Energy Envelope

“Pitch + Power Controls Energy State”

“Allocates energy from the available energy ‘envelope’ between vertical path and airspeed”

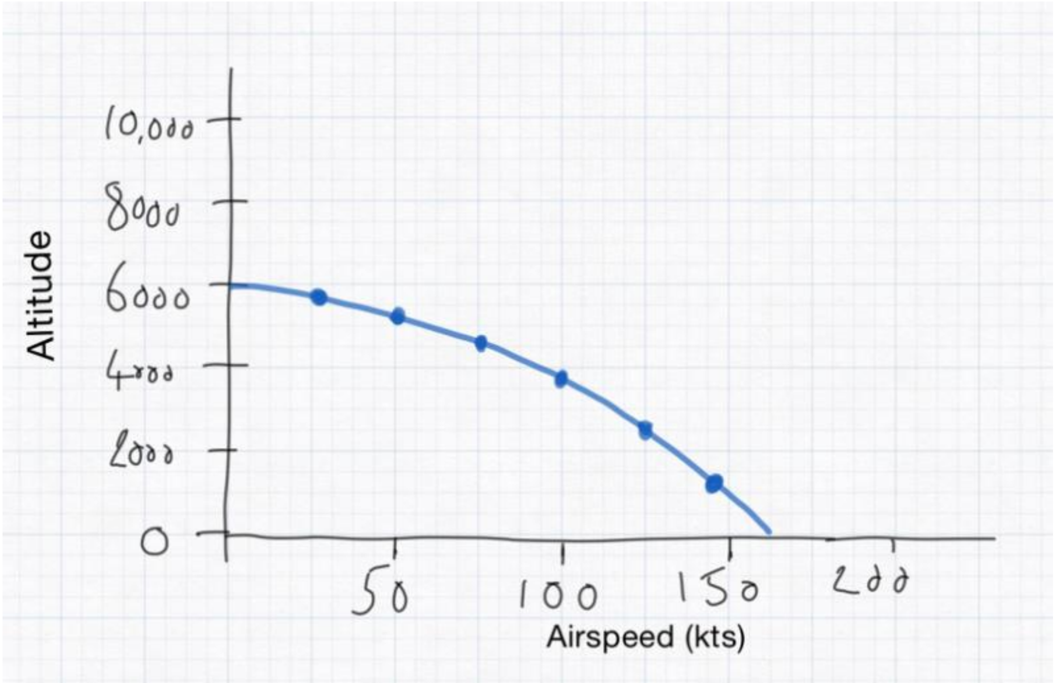
Energy Envelope

- **Given that we can exchange energy between altitude and airspeed, we can visualize an energy envelope…which encompasses available energy combinations (states)**



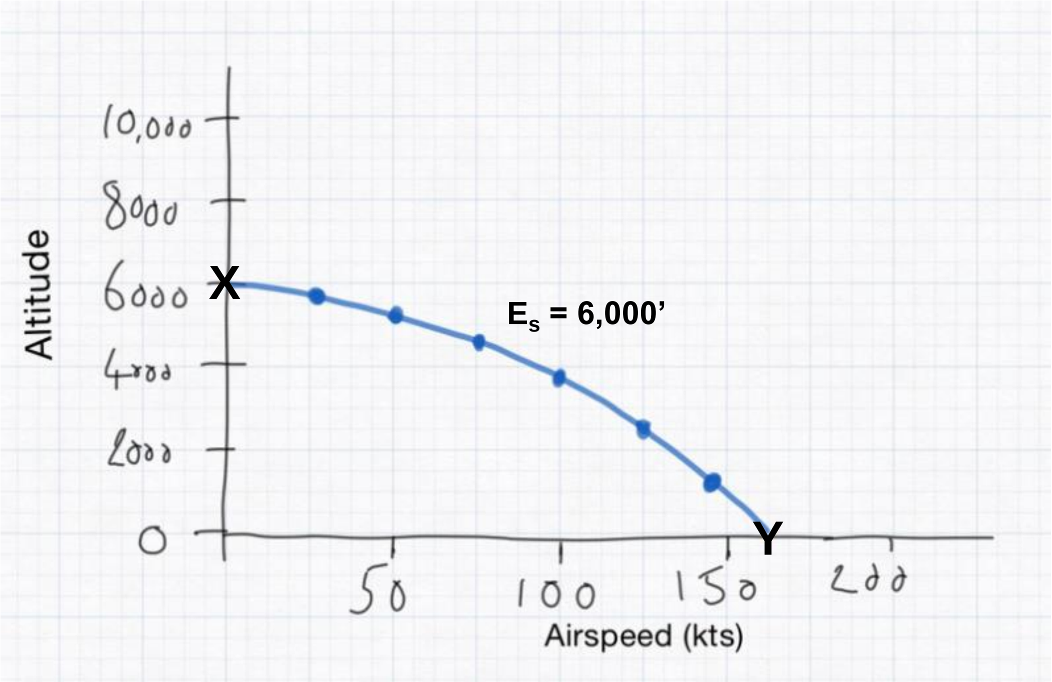
Energy Envelope

- The energy space enclosed is actually "specific total energy", E_s
- For an aircraft with a particular E_s it can move along its E_s contour, exchanging PE for KE, and KE for PE



Energy Exchange Envelope

- **The energy space enclosed is actually "specific total energy", E_s**
- **$E_s = (PE + KE)/W$**
  - F = ma
  - W = mg
- **$E_s = h + V^2/2g$ (has units of height, feet)**
- **Known as "equivalent energy height"**
  - Represents total energy as a height equivalent
- **For given E_s, we plot: $h = E_s - V^2/2g$**
- **When V = 0, E_s = h. Point X (not very practical…)**
  - All KE is converted to PE, and a/c can climb to a max altitude depending on its actual E_s
  - The energy contour is labeled by this height…6,000' here
- **When h = 0, all PE is converted to KE giving max velocity. Point Y**



Here, a/c has E_s of 6,000'.

It can exchange altitude for speed and vice-versa, along the energy contour

Energy Exchange Envelope

- We now plot all possible E_s curves
- From $E_s = h + V^2/2g$
- $h = E_s - V^2/2g$
- We can plot this for all (reasonable) values of E_s
- Here, an aircraft with E_s = 6,500', can exchange PE and KE along the 6,500' contour
- We exchange altitude for speed and vice-versa
- The a/c has the energy to "zoom climb" to 6,500' from any point on the contour (ending up at zero speed so not particularly useful!)
- Could draw a vertical line at the minimum controllable airspeed

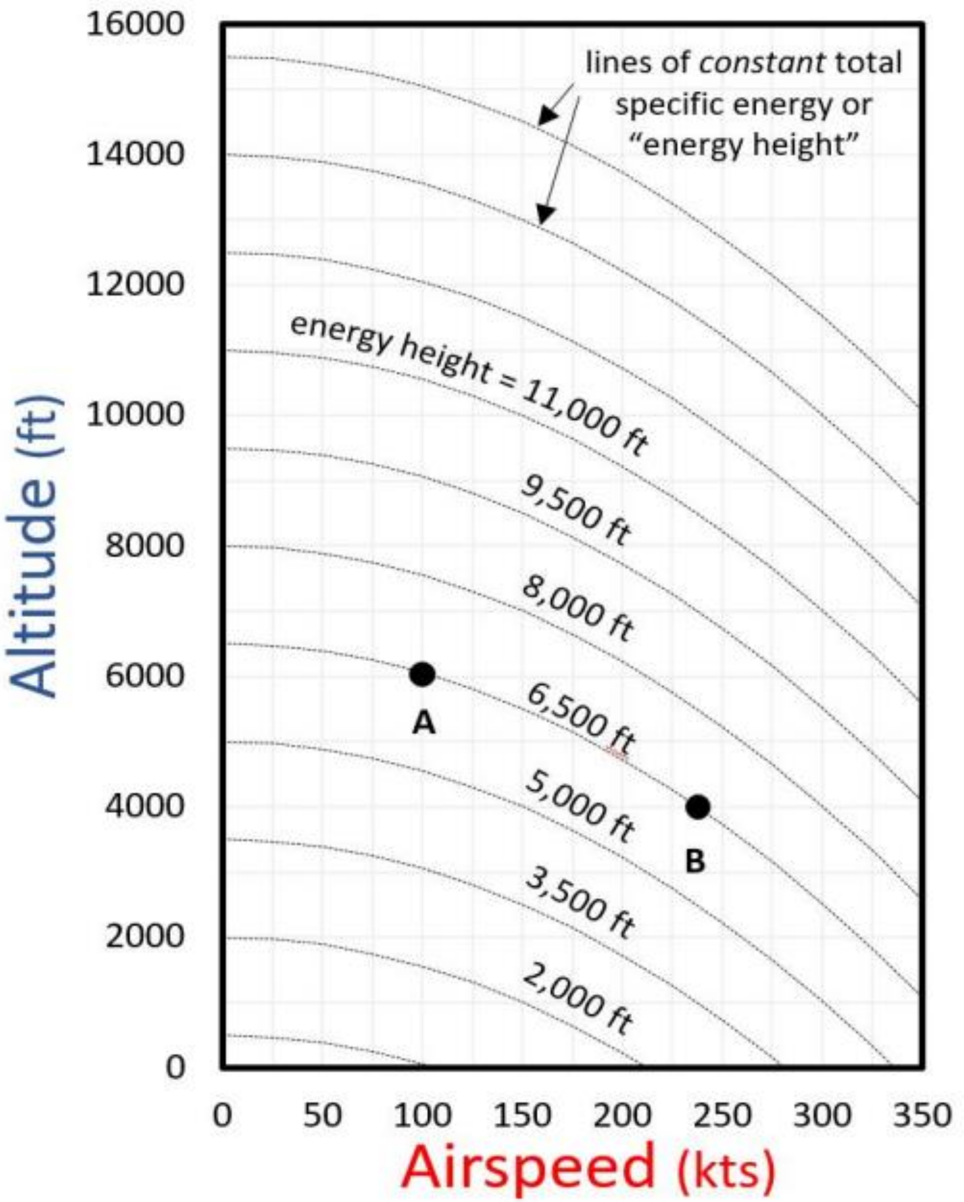


Figure 4-6. *The altitude-speed "map" showing lines of constant energy height.*

Energy Jumps

- **Okay…but how do we move up or down to a different E_s contour?**
- **We saw earlier that in order for an aircraft to climb at a constant airspeed, there needs to be available excess power**
- **We can only move between energy contours by adding energy (adding power)…that is, by using some of the available excess power**
- **For a given aircraft (engine and prop) we can plot P_s = Specific Excess Power contours…for various rates of climb**
  – Which is rate of change of height = feet per minute
- **As long as we have sufficient excess power, we can move between energy contours**

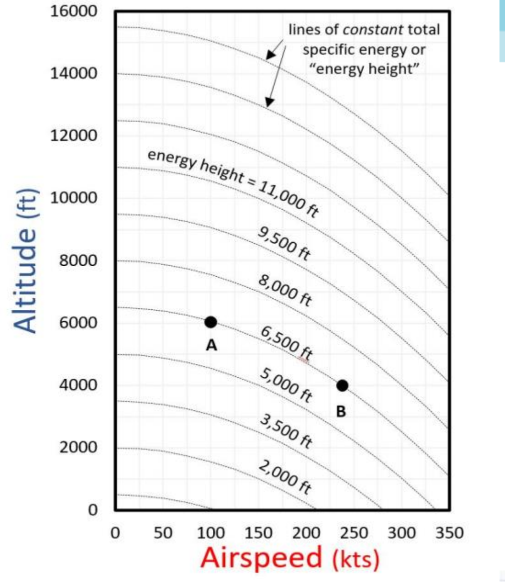
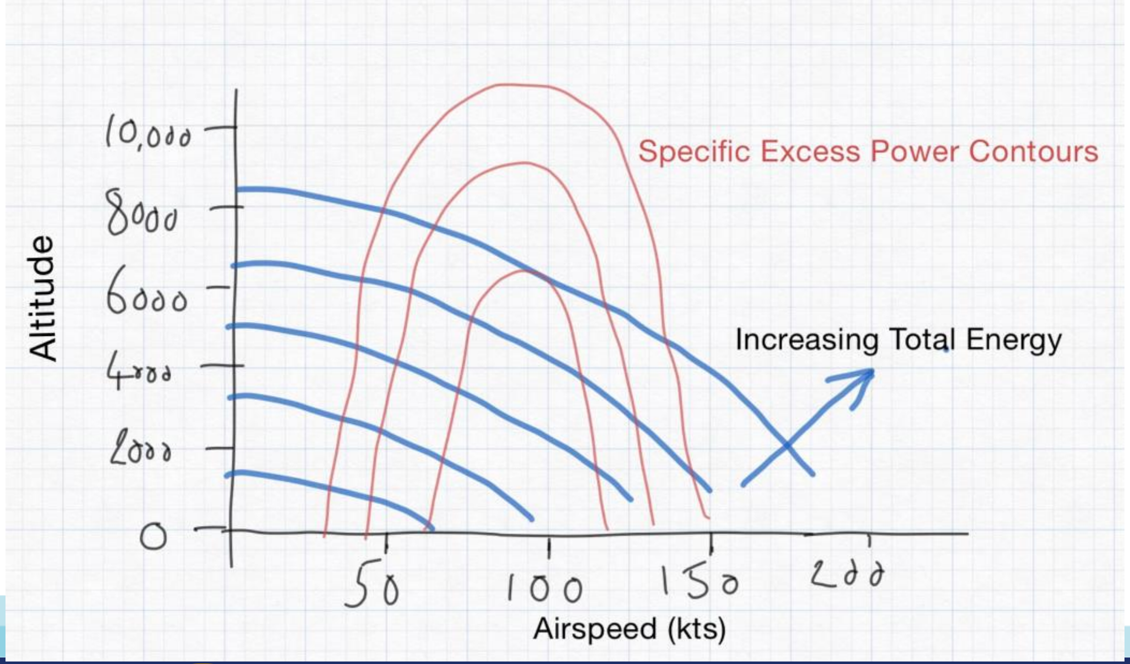


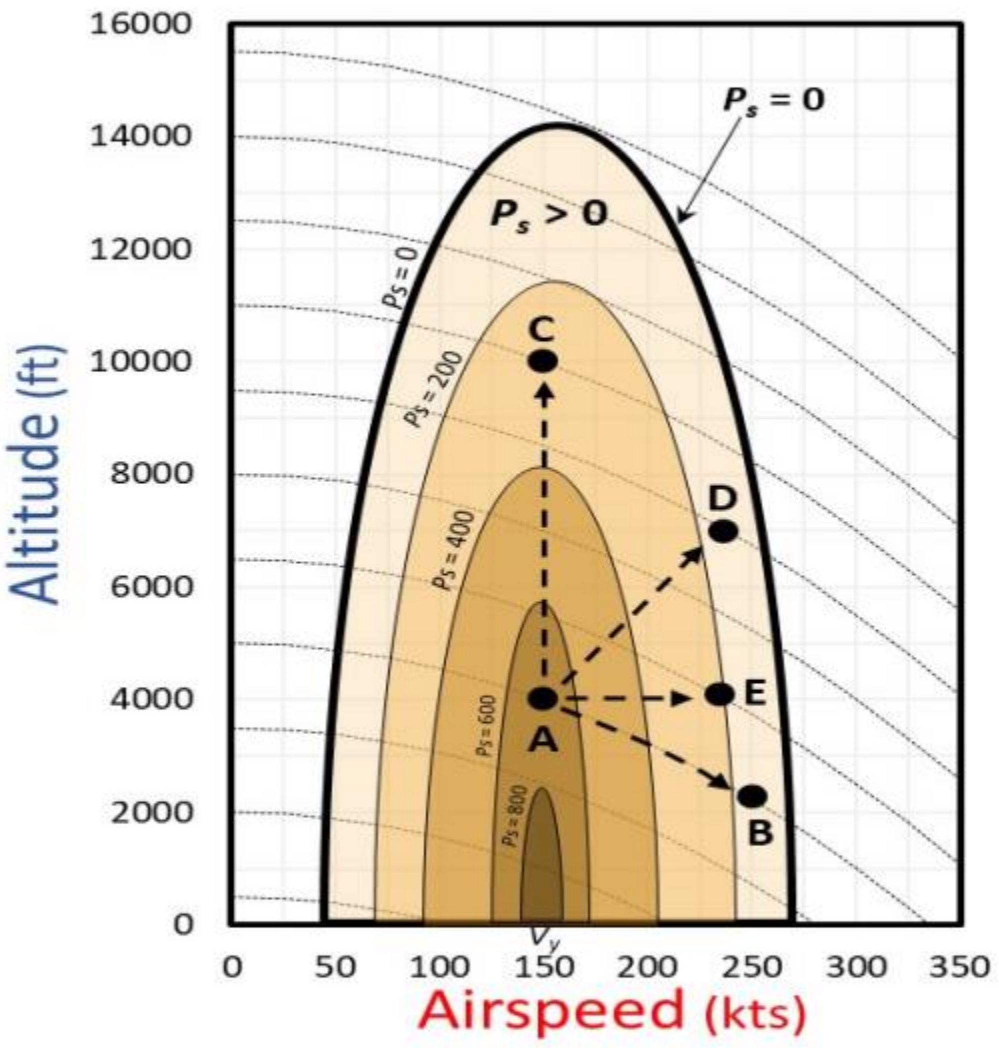
Figure 4-6. *The altitude-speed "map" showing lines of constant energy height.*



Energy Jumps

- **The bold P_s curve is where the available specific power has reduced to zero**
- **On and outside the Ps = 0 curve, the a/c cannot climb and maintain airspeed, or accelerate without descending**
- **At the peak of the P_s curves, and at full throttle, the aircraft can:**
  - Reach the best rate of climb whilst maintaining airspeed. V_y = 150 kts, here.

    OR
  - Achieve maximum acceleration without descending

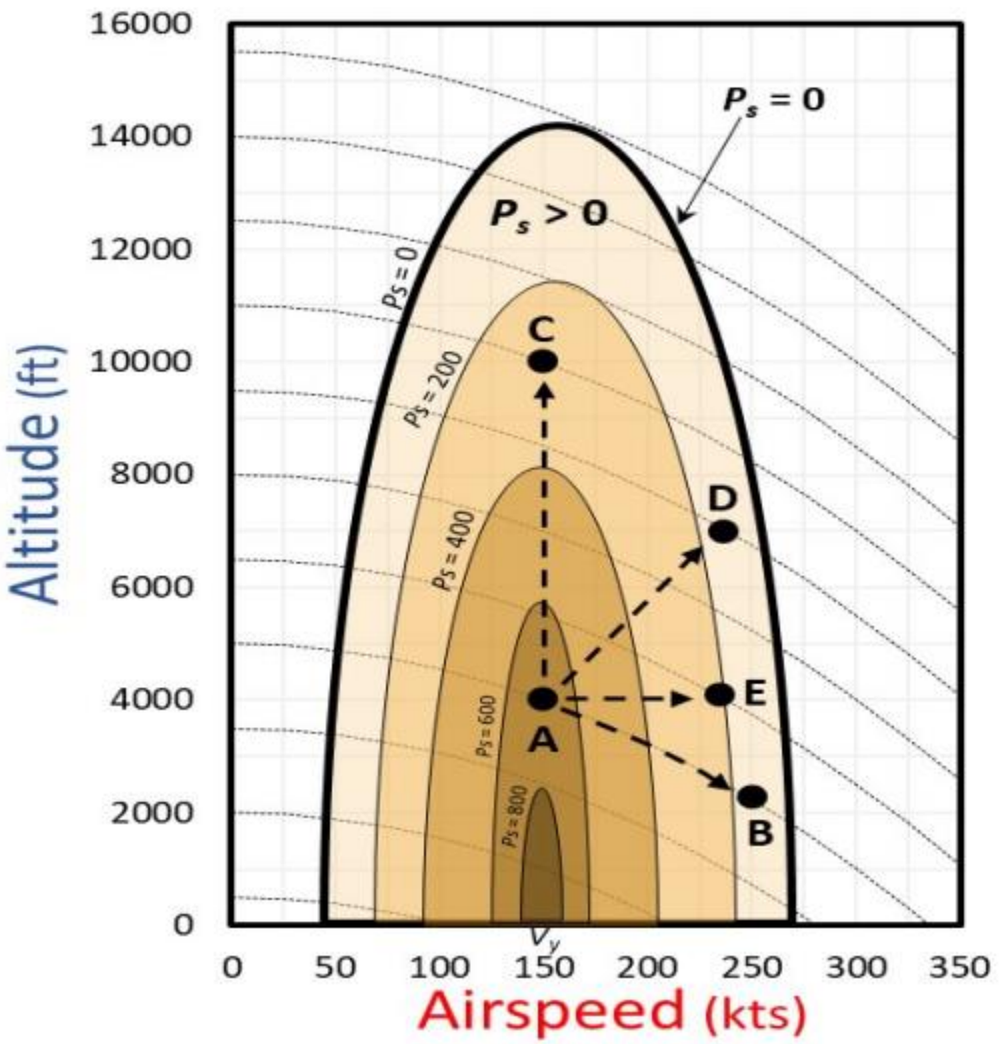


Energy Jumps

- **Example:**

1. Aircraft energy is at point A

a. At 150 kts, 4,000 feet with a total equivalent energy height 5,000’
b. We can move along the 5,000’ curve without adding any energy…just converting it
c. We can move anywhere inside the bold $P_s < 0$ curve, by adding or reducing power
d. If we increase thrust (T>D)
e. We could decide to climb at V_y to point C
f. We start off with lots of excess power which permits a ROC of > 600 FPM
g. As we approach point C, excess power has reduced and the ROC lowers to around 200 FPM (still at V_y which reduces with altitude)

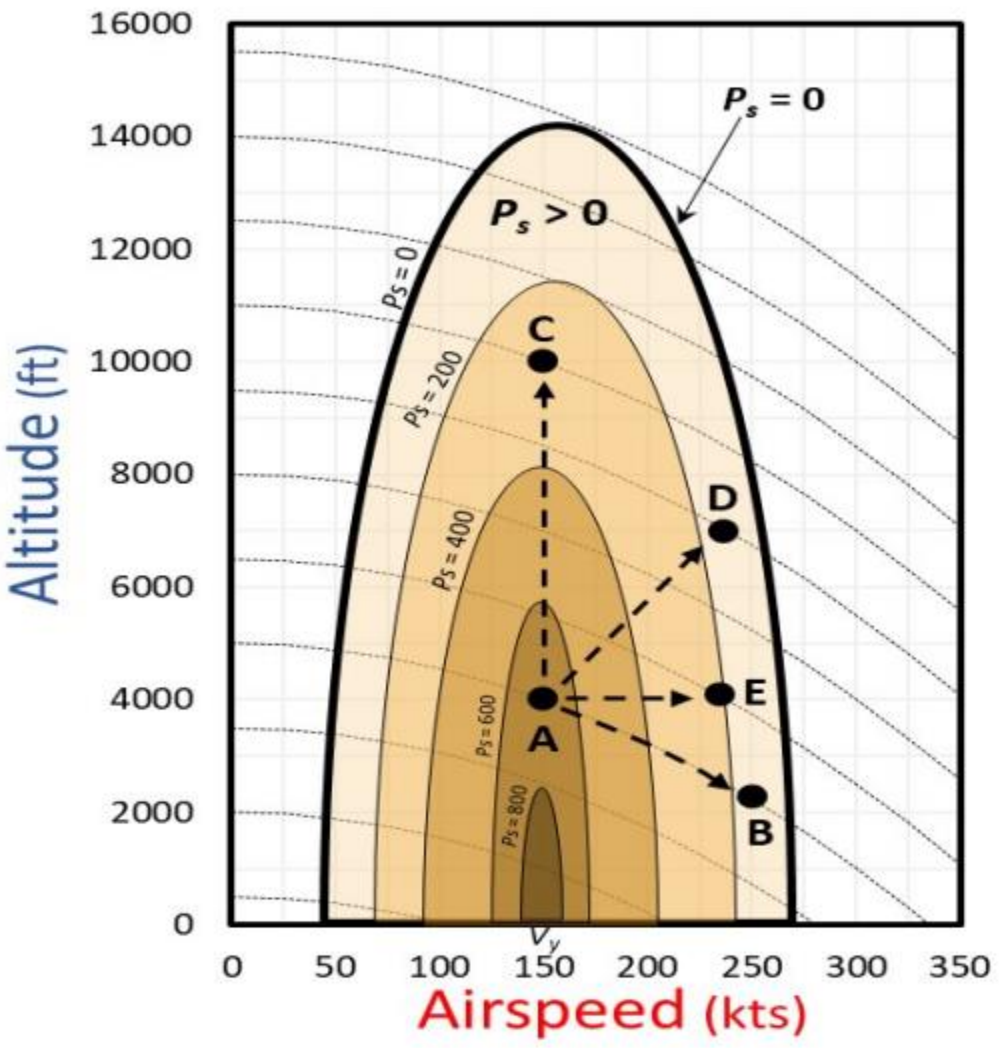


Energy Jumps

- **Example:**

2. Aircraft energy is at point A

a. At 150 kts, 4,000 feet with a total equivalent energy height 5,000’
b. We can move along the 5,000’ curve without adding any energy…just converting it
c. We can move anywhere inside the bold P_s < 0 curve, by adding or reducing power
d. If we increase thrust (T>D)
e. We could decide to climb to point D
f. We have sufficient available excess power (with full throttle) to climb to 7,000’ and accelerate to 250 kts



Operational Transitions

- **We an use an energy map to better understand control inputs**
- **It shows aircraft trajectories from some starting point to other points:**
  - Moving along an energy contour using elevator but without adding more energy – from 1 to 6 or 7 (green arrows)
  - Adding energy – from 1 to 2 or 3 (blue arrow)
  - Reducing energy – from 1 to 4 or 5 (red arrow)
- **From point 1, we need to add energy to get into the blue region and reduce energy to get into the red region**
- **Throttle adds or subtracts energy**
- **Elevator distributes the new total energy between altitude and airspeed**

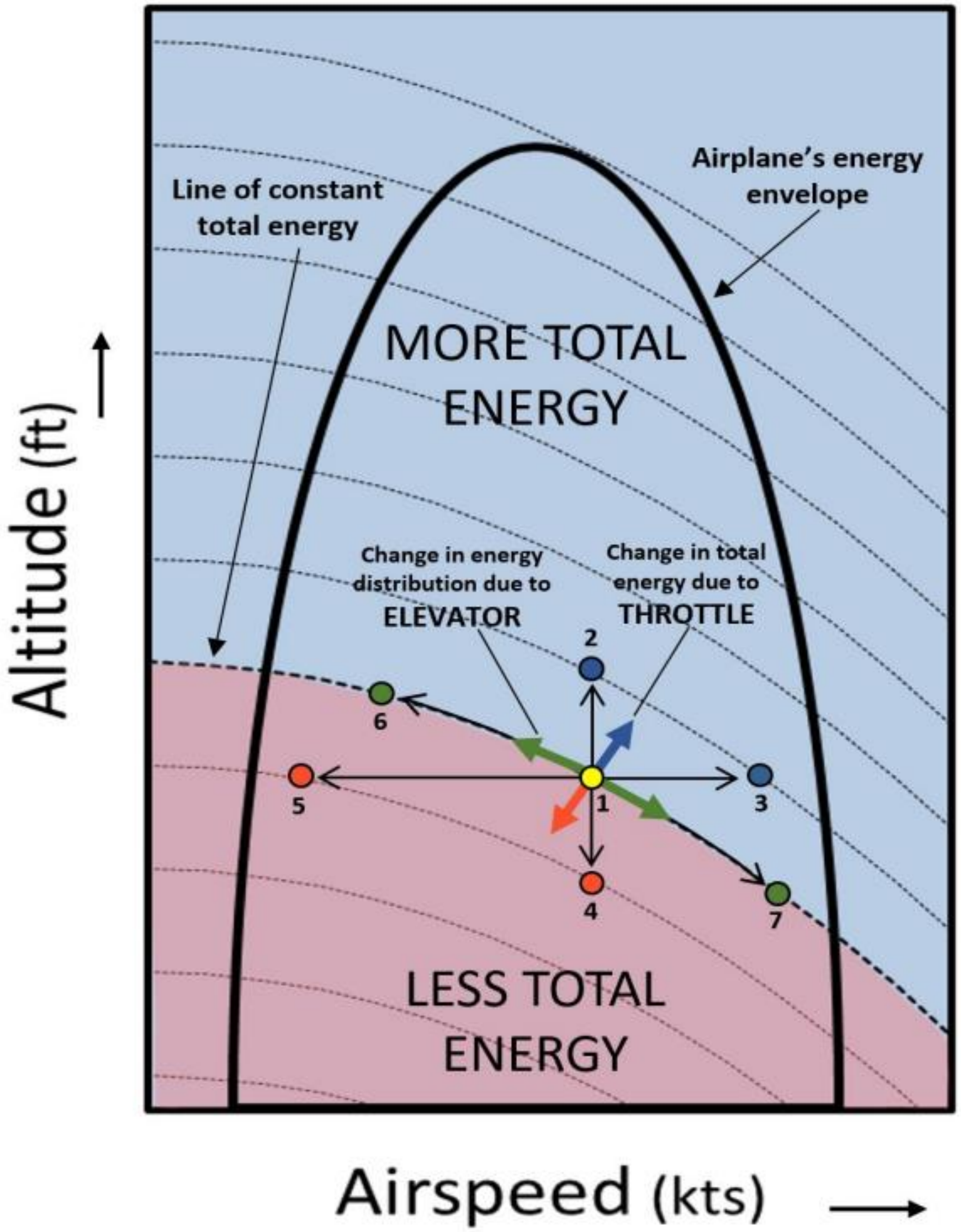


Figure 4-8. *The energy-control map helping to visualize the basic energy control rules.*

Operational Transitions

- **From 1 to 2 or 3:**
  - Must increase throttle to increase total energy to the higher energy contour
  - Same amount of energy increase here, as 2 and 3 are on the same (target) energy contour
  - The difference between 2 and 3 depends on elevator inputs to distribute altitude and airspeed
  - This is visualized with the blue arrow (adding energy) and green arrows (distributing energy)
- **Transition from 1 to 2 is a constant airspeed climb, up to a higher altitude**
  - Increase throttle
  - Apply up elevator to climb at constant airspeed, rather than accelerate to a higher airspeed
  - Adjust throttle and trim when on target
- **Transition from 1 to 3 is a constant altitude transition to a higher airspeed**
  - Increase throttle
  - Apply gradual down elevator as speed increases
  - Adjust throttle and trim when on target

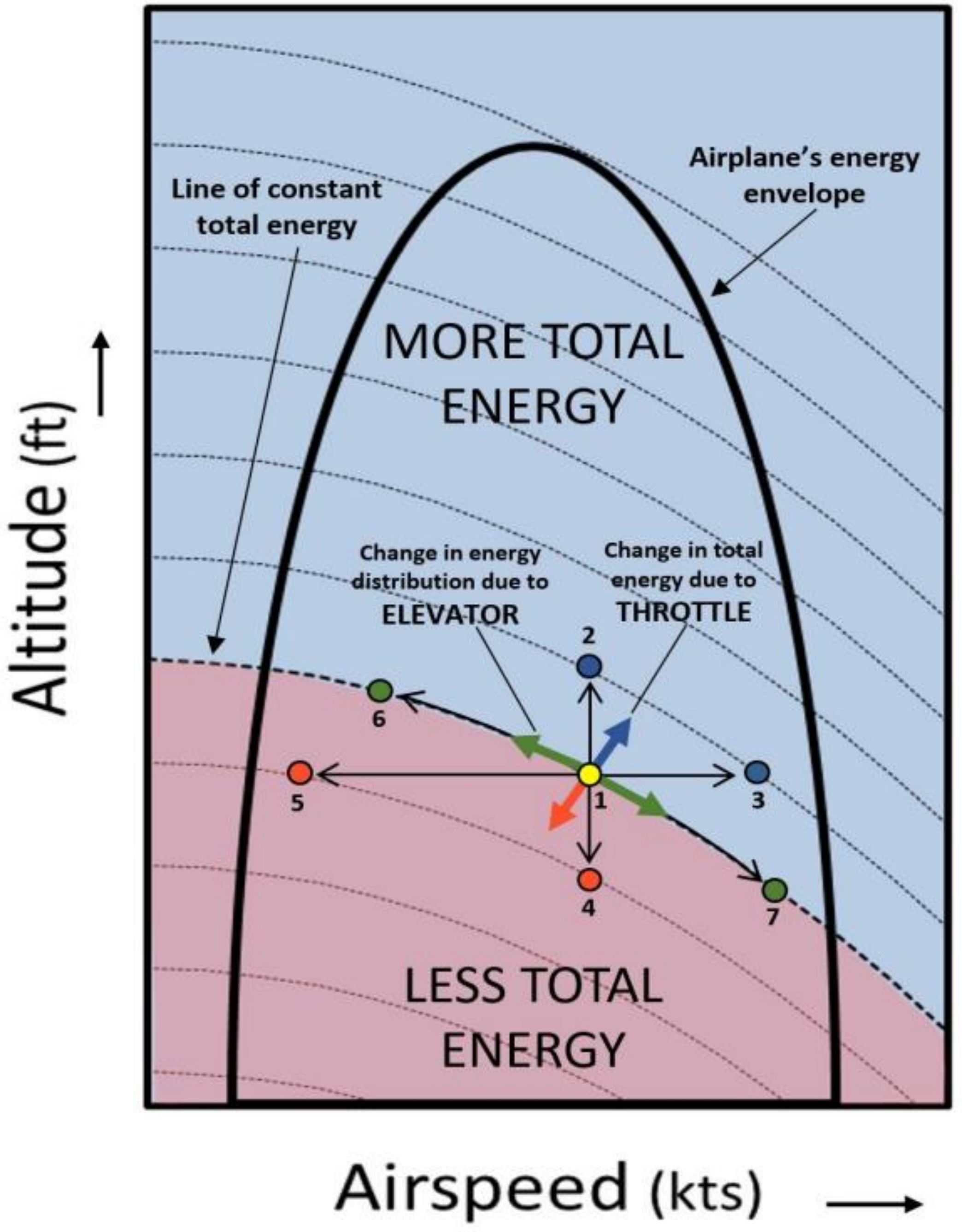


Figure 4-8. *The energy-control map helping to visualize the basic energy control rules.*

Operational Transitions

- **From 1 to 4 or 5:**
  - Must decrease throttle to lower total energy to the lower energy contour
  - Same amount of energy decrease here, as 4 and 5 are on the same (target) energy contour
  - The difference between 4 and 5 depends on elevator inputs to distribute altitude and airspeed
  - This is visualized with the red arrow (removing energy) and green arrows (distributing energy)
- **Transition from 1 to 4 is a constant airspeed descent to a lower altitude**
  - Decrease throttle
  - Apply down elevator maintain constant airspeed
  - Adjust throttle and trim when on target
- **Transition from 1 to 5 is a constant altitude transition to a lower airspeed**
  - Decrease throttle
  - Apply gradual up elevator as speed decreases
  - Adjust throttle and trim when on target

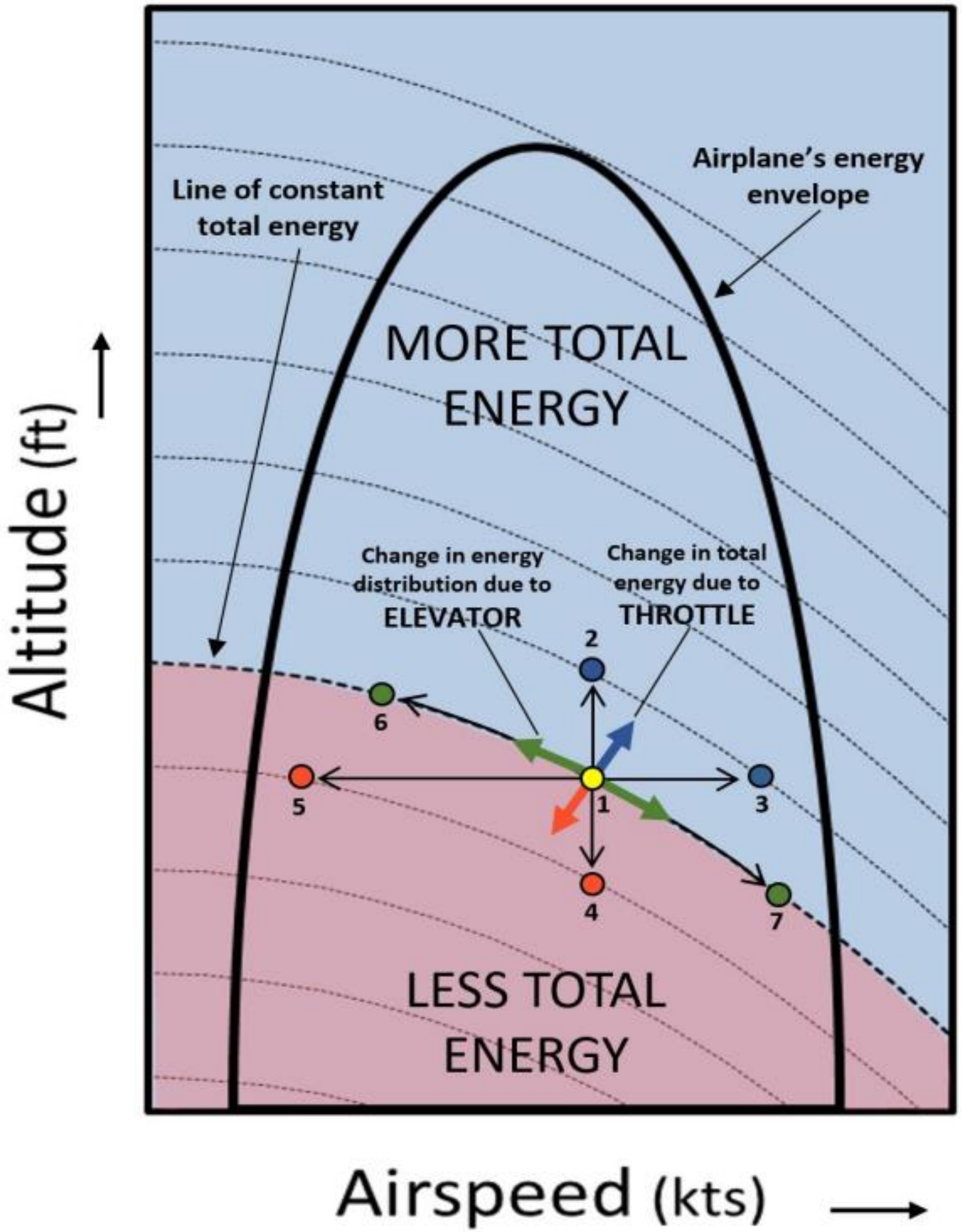


Figure 4-8. *The energy-control map helping to visualize the basic energy control rules.*

Operational Transitions

- **From 1 to 6 or 7:**
  - Points 6 and 7 are on the same energy contour as 1, so no change in throttle required (an exchange transaction)
- **Transition from 1 to 6 is increasing altitude at expense of reducing airspeed**
  - No initial change in throttle
  - Apply up elevator to climb at lowering airspeed
  - Adjust throttle and trim when on target
- **Transition from 1 to 7 is increasing airspeed at expense of reducing altitude**
  - No initial change in throttle
  - Apply down elevator to descend and increase speed
  - Adjust throttle and trim when on target

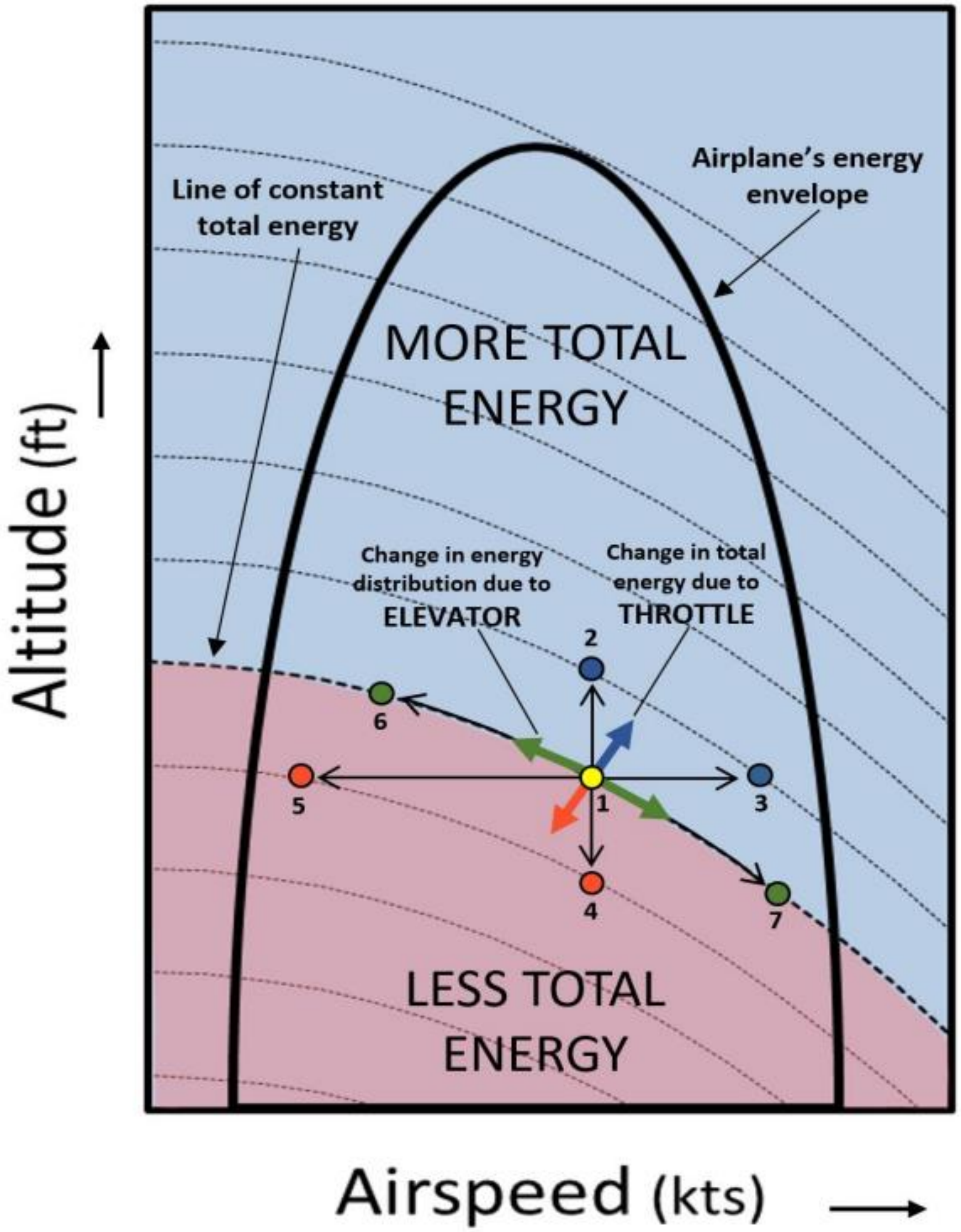


Figure 4-8. *The energy-control map helping to visualize the basic energy control rules.*

Control Input Rules

- **Rule 1: Move to a higher energy state**
  - Increase throttle (T>D)
  - Adjust pitch attitude as required to distribute energy:
    - For constant speed climb
    - To accelerate at a constant attitude
- **Rule 2: Move to a lower energy state**
  - Reduce throttle (T<D)
  - Adjust pitch attitude as required to distribute energy:
    - For constant speed descent
    - To decelerate at a constant attitude
- **Rule 3: Same energy state, but different distribution of altitude and speed**
  - No initial change in throttle
  - Adjust pitch attitude as required to distribute energy:
    - Pitch up to gain altitude and slow down
    - Pitch down to lose altitude and speed up
- **Adjust throttle and trim when on target**

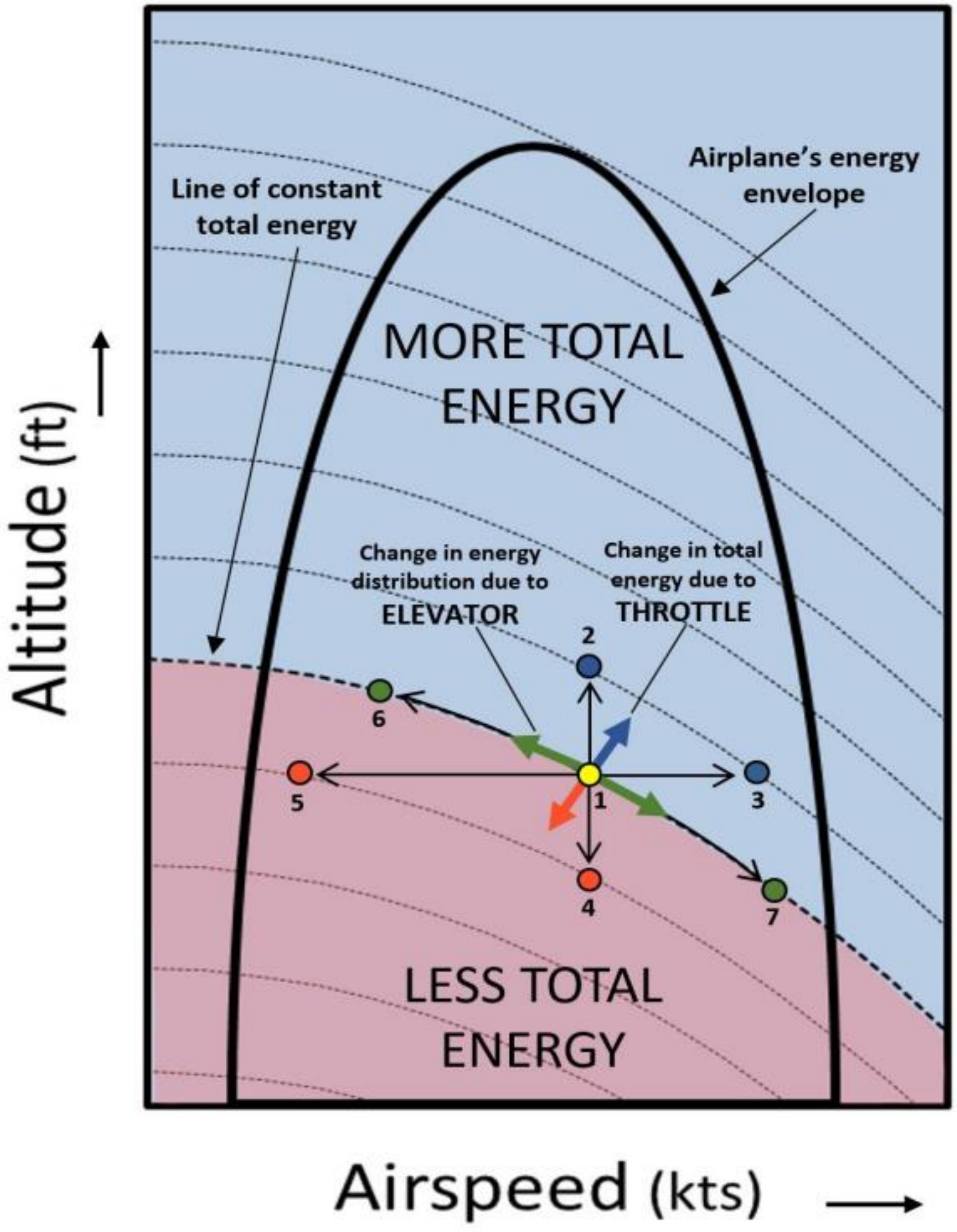


Figure 4-8. *The energy-control map helping to visualize the basic energy control rules.*

Part 1 End

- **Next Month—Energy Management, Part 2**
  - Part 1 Review
  - Energy Scenarios and Examples

- **But before we go…**

Why *WINGS*?

5. ***WINGS* Training yields rewards!**
4. ***WINGS* Proficiency training works!**
3. ***WINGS* coaching gets results!**
2. ***WINGS* broadens your horizons!**
1. ***WINGS* pilots are:**
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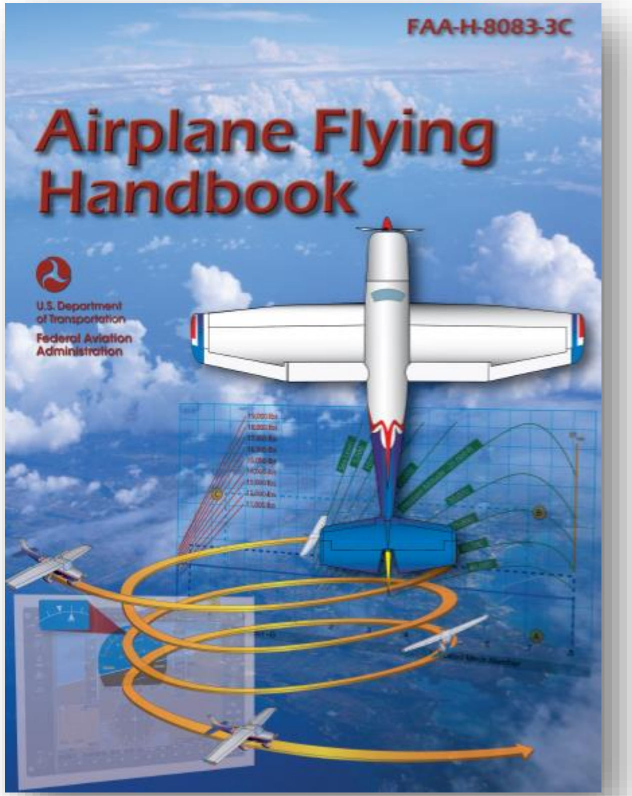
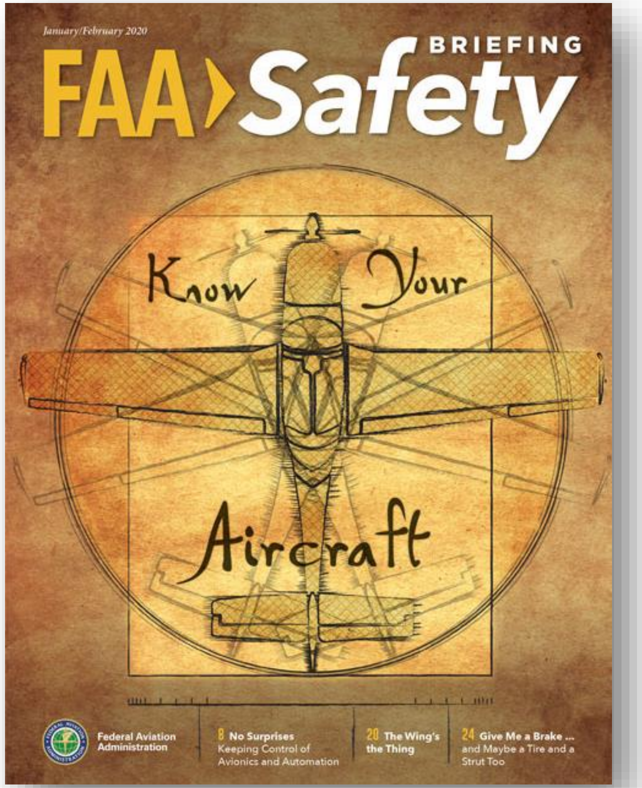


https://tinyurl.com/mr2jux65



On the Money: Getting To Know Your Airplane as an Energy System

https://tinyurl.com/2s42pxmm

Homework-1: GA Proficiency

- https://youtu.be/3o8_f57828U

Next Month…

The National FAA Safety Team Presents

Federal Aviation Administration

Topic of the Month—May

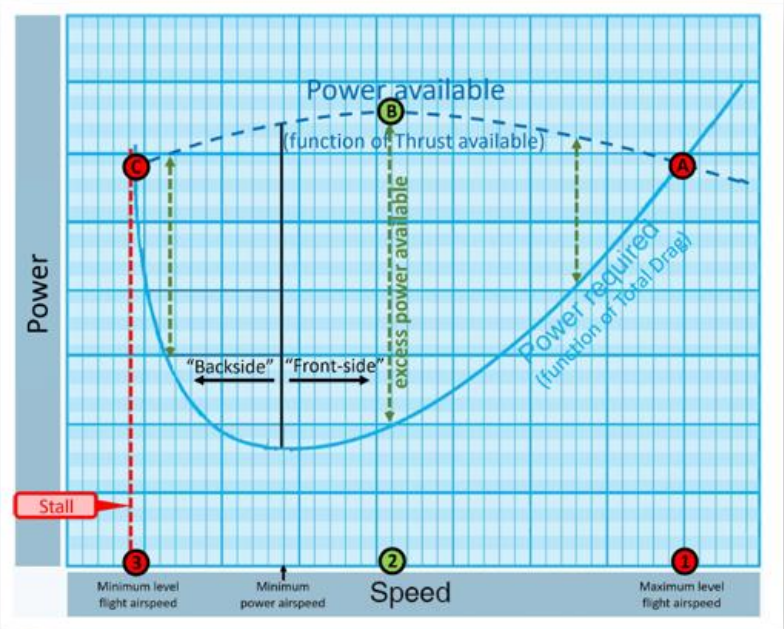
Energy Management—Part 2 (of 2)

Presented to: Safety Minded Aviators, Everywhere…

By: Stephen Bateman, CFI, Chocks Away Aviation, LLC

Date: Tuesday 21st May 2024

Produced by:
The National FAA Safety Team (FAASTeam)



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