VICTORIA FLYING CLUB

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Part II – Climbing and Descending Turns, Steep Turns

- Review *Basic* Turns, Climbs and Descents
- Definition and Motivation
- Initiating, Maintaining and Recovering Coordinated **Climbing** and **Descending Turns**
- Initiating, Maintaining and Recovering Coordinated **Steep Turns**
- Summary and Questions
- Pre-Flight Briefing

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Review Basic Turns, Climbs and Descents

- What **controls** are to be used to **maintain** a *coordinated* **level turn** and what do they achieve individually?
- Mentally perform a **medium** (30° bank angle) *coordinated* **level turn** describing all required actions.
- Describe **overbanking** and how it has to be corrected for during a medium level turn.
- Mentally perform a **basic climb** and **level off** and state all required actions. (**APT**)
- Mentally perform a **basic power-off descent** and **level off** and state all required actions. (**PAT**)
- How do we establish and maintain a **combined nose-up** and **left-banked** attitude?

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Climbing and Descending Turns

- Turning *while* climbing or descending
- **Heading** and **altitude** change *simultaneously*
- Applications: **Departures**, **Arrivals**, **Circuits**

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Initiating a Climbing Turn

- In cruise-attitude **lookout** ahead and above in turn direction
- Establish a *stable* **constant speed climb** *first* – **APT**
- Establish a *coordinated* **constant rate turn** *second*
- Climbing turns will be established *simultaneously* later

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Maintaining a Climbing Turn

- Apply **elevator** as *required* to maintain **pitch attitude** and **airspeed**
- Apply **aileron** as *required* to maintain **bank attitude** *while* correcting **overbanking** tendencies
- Apply **rudder** as *required* to maintain *coordinated* **constant rate turn**
- Continue **lookout** and monitor outside **references** and **instruments**

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Recovering a Climbing Turn

- Continue to **lookout** observing **references** during recovery
- Recovery order depends on achieved target (heading or altitude) and may require *simultaneous* control inputs
- **Anticipate** turn recovery to establish desired **heading** – ***half bank angle***
- **Anticipate** climb recovery to establish desired **altitude** – ***10% VSI***
- Remain **coordinated** using **rudder** and apply **APT** to recover climb

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Initiating a Descending Turn

- In cruise-attitude **lookout** ahead and below in turn direction
- Establish a *stable* **constant speed descent** *first* – **PAT**
- Establish a *coordinated* **constant rate turn** *second*
- Descending turns will be established *simultaneously* later

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Maintaining a Descending Turn

- Apply **elevator** as *required* to maintain **pitch attitude** and **airspeed**
- Apply **aileron** as *required* to maintain **bank attitude** *while* correcting **underbanking** tendencies
- Apply **rudder** as *required* to maintain *coordinated* **constant rate turn**
- Continue **lookout** and monitor outside **references** and **instruments**

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Recovering a Descending Turn

- Continue to **lookout** observing **references** during recovery
- Recovery order depends on achieved target (heading or altitude) and may require *simultaneous* control inputs
- **Anticipate** turn recovery to establish desired **heading** – ***half bank angle***
- **Anticipate** climb recovery to establish desired **altitude** – ***10% VSI***
- Remain *coordinated* using **rudder** and use **PAT** to recover climb

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Steep Turns

- **Steep** turns – beyond ***30°*** bank angle
- **Evasive actions** and collision avoidance (consider climbs and descents), **canyon turns**, **steep descending turns**
- Control **coordination practice**
- Higher **load factor**, **stall speed** and **required power**

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Performing a Steep Level Turn

- Initiate steep level turn like medium level turn
- Increase **power** *slightly* beyond ***30°*** bank angle to maintain **safe airspeed** above increased stall speed
- Correct as *required* to maintain **pitch** and **bank attitude**
- Remain **coordinated** and correct **overbanking** tendencies
- Left and right turns require *different* control inputs
- Reduce **power** smoothly during recovery
- Transition from left to right requires *smooth* **control** and **power** adjustments

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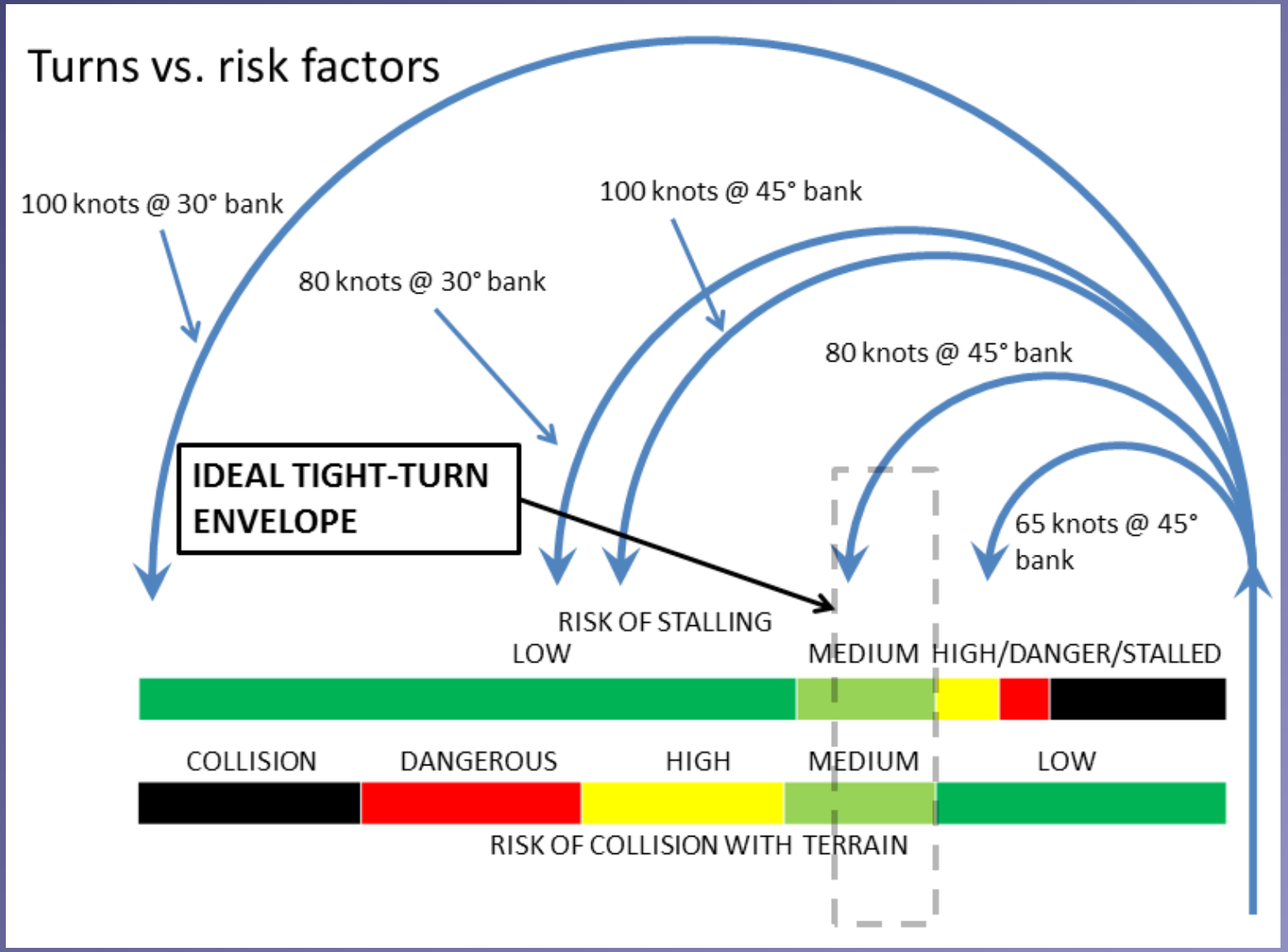
Minimum Radius Turn - Entry Speeds



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Performing a Safe Radius Turn

- Perform **lookout** before safe radius turn
- Consider **wind** for minimum radius over ground
- *Operational use* of power and configuration
- Slow down to **safe airspeed** (***Ve = 80 KIAS >= Vy = 74 KIAS***) and extend **flaps** to ***10°*** (partial flaps)
- Establish a *coordinated* steep level turn adding **power** *as required* to maintain **safe airspeed**
- Recover and accelerate to **cruise airspeed**
- Retract **flaps** *conservatively* at the top of **white arc**

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Performing a Minimum Radius Turn

- Perform **lookout** before minimum radius turn
- Consider **wind** for minimum radius over ground
- *Operational use* of power and configuration
- Slow down to **minimum airspeed** (***Ve = 60 KIAS***) and extend **flaps** in stages to ***30°*** (full flaps)
- Establish a *coordinated* steep level turn adding *full* **power** to maintain **minimum airspeed**
- Recover and accelerate to **cruise airspeed**
- Retract **flaps** to ***10°*** *immediately* and to ***0°*** *conservatively* at the top of **white arc**

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Performing a Steep Descending Turn

- Perform **lookout** before steep descending turn
- Reduce **power** to **idle** maintaining **safe airspeed** (***Ve = 70 KIAS >= 68 KIAS*** (best glide))
- Initiate steep descending turn like descending turn
- *Operational / situational use* of configuration (clean flaps)
- Correct *as necessary* to maintain **pitch** and **bank attitude**
- Remain *coordinated* and correct **underbanking** tendencies
- Avoid spiral dive and monitor **safe airspeed**
- Recover like descending turn adding **power** first – **PAT**

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Summary / Quiz

- Mentally perform a *coordinated* **climbing** (2000' to 3000') **medium** (30° bank angle) **turn** to the right (270° to 090°) describing all required actions.
- Mentally perform a *coordinated* **descending** (3000' to 2800') **gentle** (15° bank angle) **turn** to the left (090° to 270°) describing all required actions.
- Mentally perform a *coordinated* **steep** (45° bank angle) **level turn** to the left (090° to 270°) describing all required actions.

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Pre-Flight Briefing

- Exercise
- Training Area
- Departure and Arrival Procedures
- Weather Briefing / NOTAMs
- Aircraft and Documents
- Time and Fuel Requirements
- Safety Considerations and Responsibilities

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Additional Materials

- Additional materials for Turns
- Flight Instructor Guide – Exercise 9, Lesson Plans 2, 7, 8

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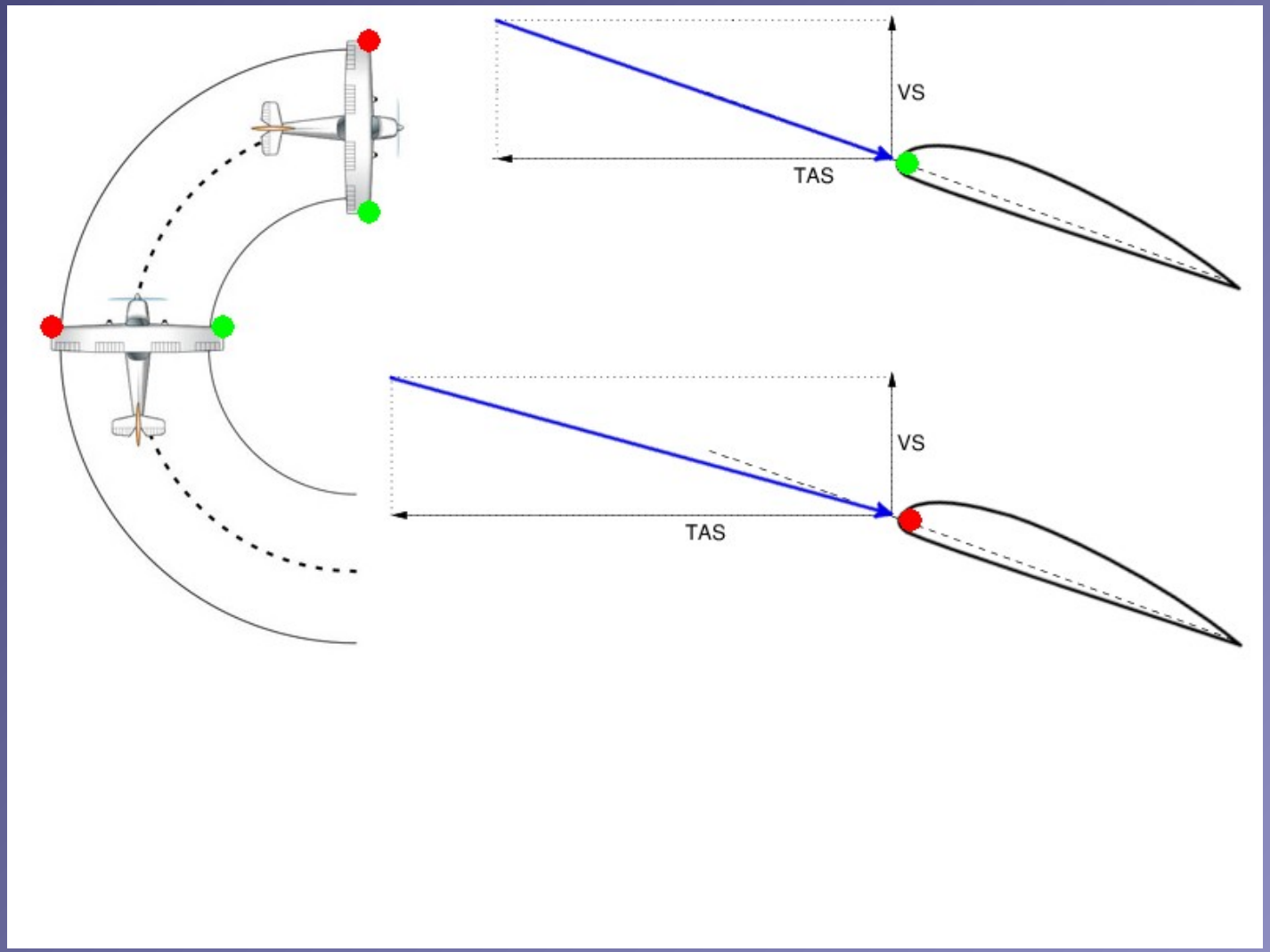
Climbing Turn – Overbanking



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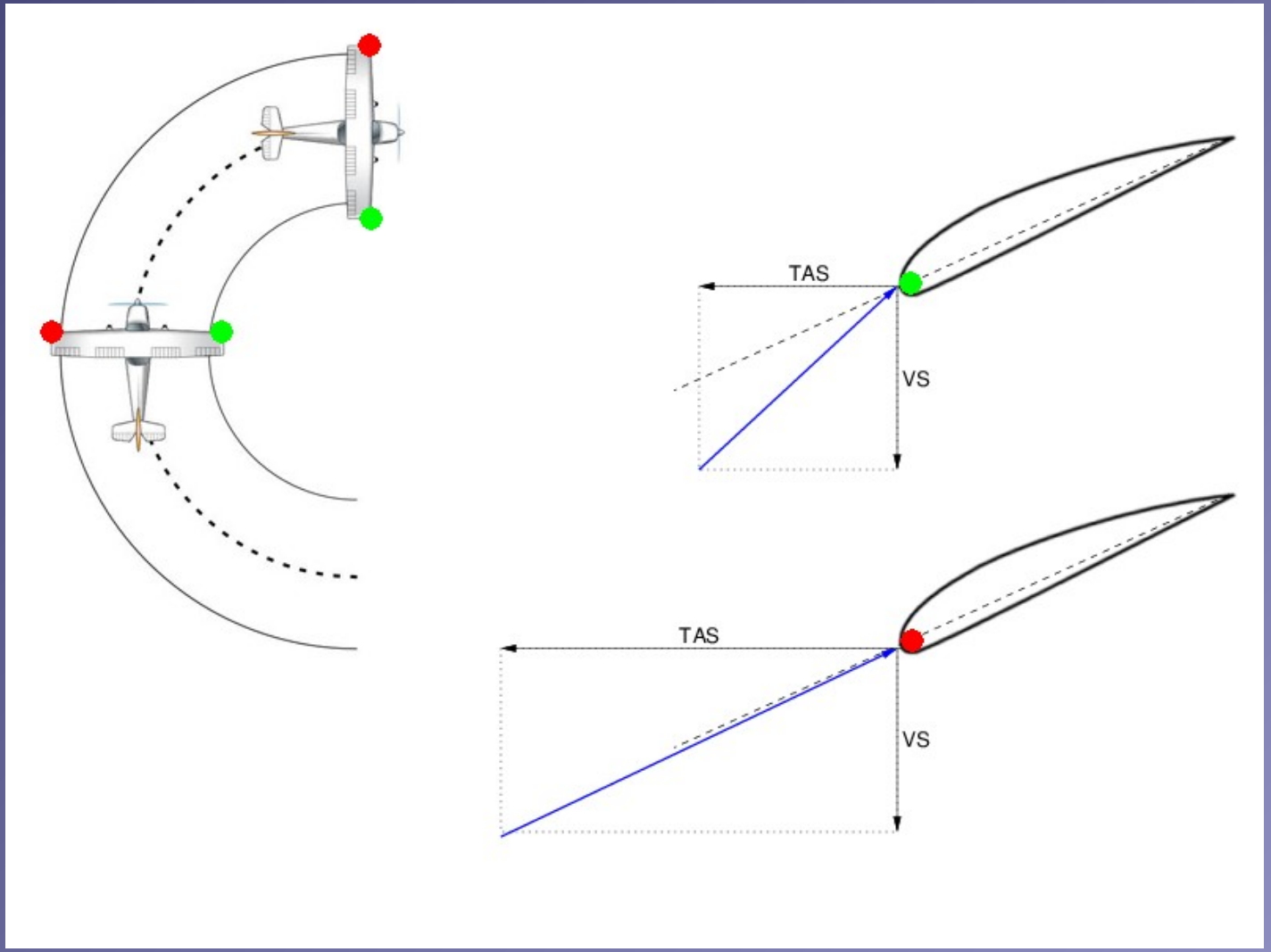
Descending Turn – Underbanking



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Turn Factors

Turn Facts and Factors

- At a constant TAS, increasing the bank decreases the turn radius and increases the rate of turn.
- To maintain a constant rate of turn, more speed requires more bank.
- At a constant bank angle, increasing speed increases the turn radius and decreases the rate of turn.
- A steeper bank angle reduces radius and increases rate of turn, but produces a higher load factor.
- Load factor is directly related to bank angle, so the load factor for a given angle is the same at any speed.
- Reducing TAS reduces turn radius and increases rate of turn without increasing the load factor.
- A given TAS will give a specific rate and radius of turn in any aeroplane.
- If TAS is doubled at constant bank, radius is quadrupled.
- If TAS is doubled at constant bank, rate of turn is halved.

$$\text{Old Rate of Turn} = \frac{V}{\text{Radius}} \qquad \text{New Rate of Turn} = \frac{V \times 2}{\text{Radius} \times 4} = \tfrac{1}{2} \text{ old rate}$$

Radius and Rate of Turn Relationship

- Bank
- Load Factor
- TAS

Circle Circumference $C = 2\pi r = \pi d$
Derive standard turn radius with given TAS
Assumption: no wind