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Attitudes and Movements

- Review Aircraft Familiarization
- Definition and Motivation
- **Normal Aircraft Attitudes**
- **Rotational Movements**
- Summary and Questions
- Pre-Flight Briefing

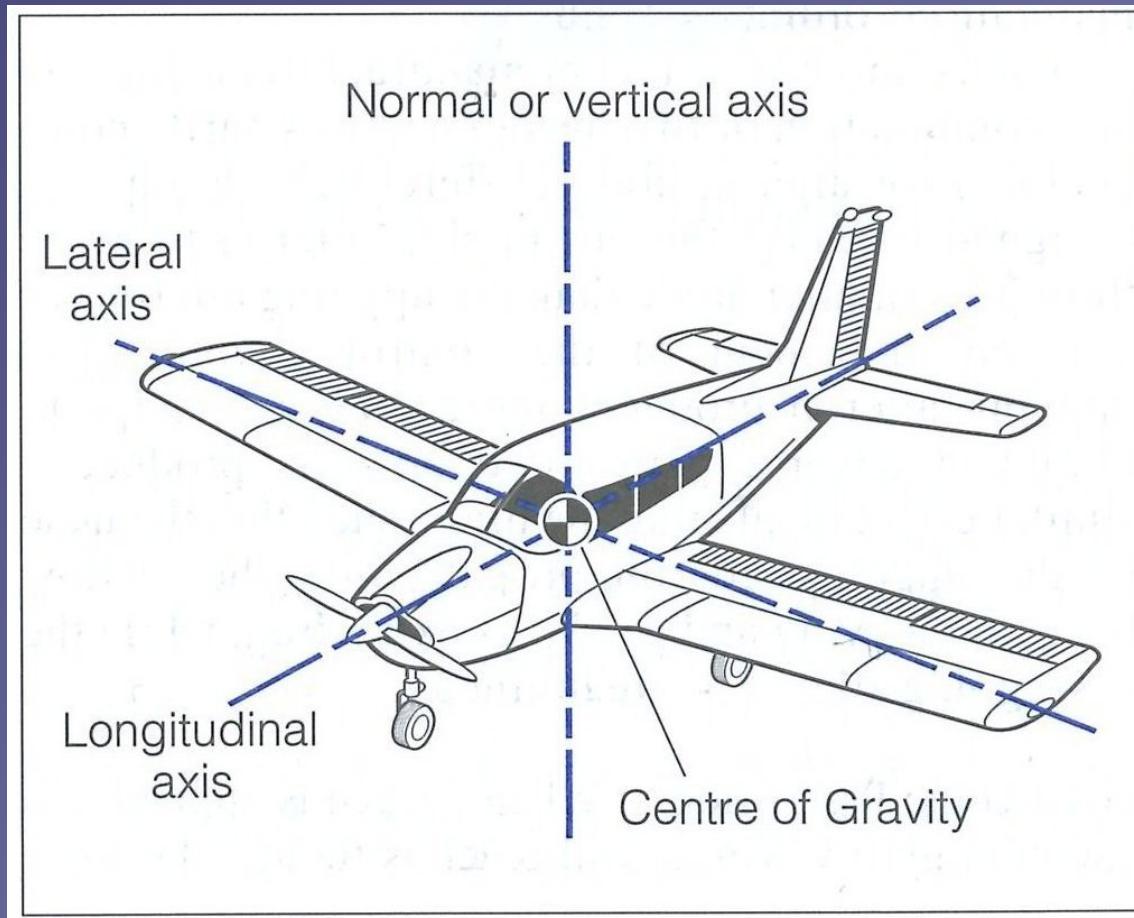


Review Aircraft Familiarization

- What are the primary control surfaces of an aircraft?
- What flight control inputs cause which reaction of the primary control surfaces?
- What information do the basic flight instruments provide?



Attitudes and Movements





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Cruise Attitude



- Power settings: **2100 (low)**, **2300 (normal)**, **2500 (high)**
- Airspeeds: *approximately 90 to 120 knots*



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Cruise Attitude





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Pitch Attitudes: Nose-Up Attitude

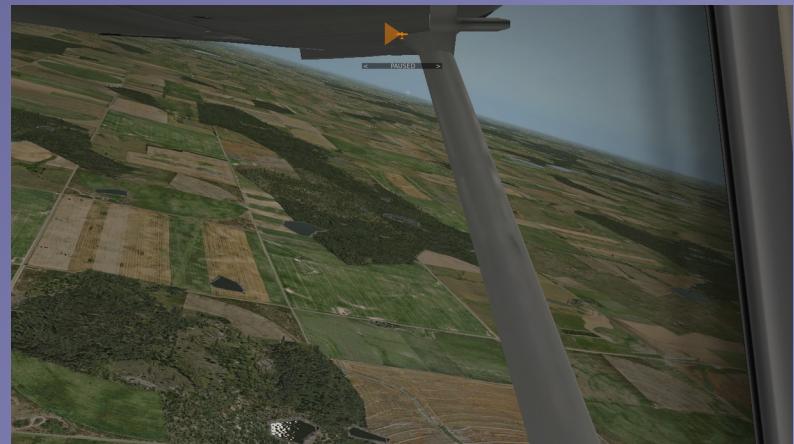


- Normal **nose-up** attitudes range up to **+15°**



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Pitch Attitudes: Nose-Up Attitude





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Pitch Attitudes: Nose-Down Attitude



- Normal **nose-down** attitudes range down to **-10°**



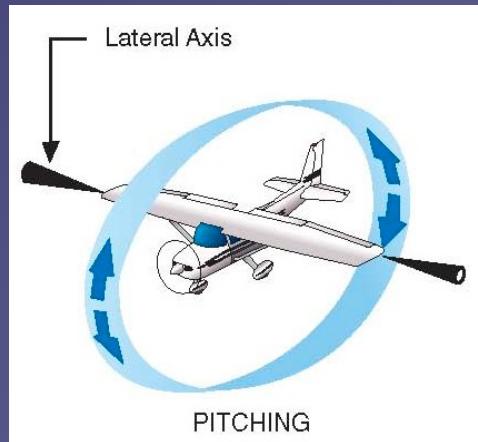
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Pitch Attitudes: Nose-Down Attitude





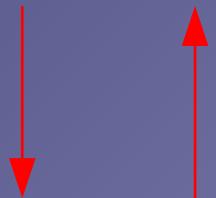
Movements - Pitching



- **Pitching** is a rotational movement about the **lateral axis**
- Pitching changes the **pitch attitude** of the aircraft: **nose-up, down**
- Pitch is primarily controlled with the **yoke** (control column, stick)
- Pushing or pulling the yoke results in **elevator deflection**
- **Trim** is used to reduce control forces while maintaining attitude
- Real and artificial horizon reference (**attitude indicator**) change



Establishing and Recovering a Pitch Attitude



Push / Pull, Adjust Pressure to Hold Attitude

- Only **small movements** required to change **attitude**
- Control pressures change *gradually* after **establishing** and **holding** new pitch **attitude**
- **Trim** may help to relieve control pressures



Bank Attitudes: Left-Banked Attitude



- Normal **left-banked** attitudes range down to **-30°**



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Bank Attitudes: Left-Banked Attitude





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Bank Attitudes: Right-Banked Attitude



- Normal **right-banked** attitudes range up to **+30°**



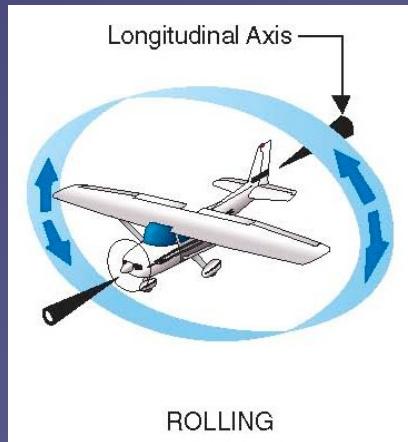
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Bank Attitudes: Right-Banked Attitude





Movements - Rolling



- **Rolling** is a rotational movement about the **longitudinal axis**
- Rolling changes the **bank attitude** of the aircraft: **left-, right banked**
- Bank is primarily controlled with the **yoke** (control column, stick)
- Rotating the yoke left or right results in **aileron** deflection
- Real and artificial horizon reference (**attitude indicator**) change



Establishing, Maintaining and Recovering a Banked Attitude



Select



Neutralize

- Rotation **angle** controls **rate of roll**
- **Select** rotation angle *until* banked attitude is established
- **Neutralize** yoke to *Maintain* banked attitude
- **Select** opposite rotation angle *until* cruise attitude is established
- **Neutralize** yoke to *Maintain* cruise attitude



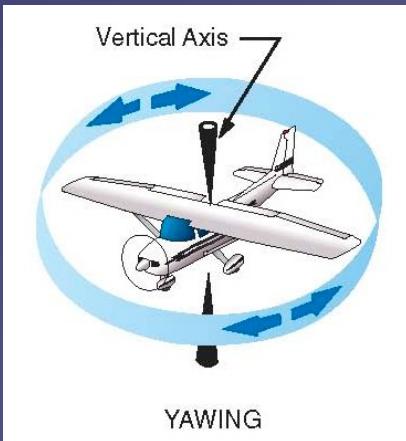
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Combined Attitudes





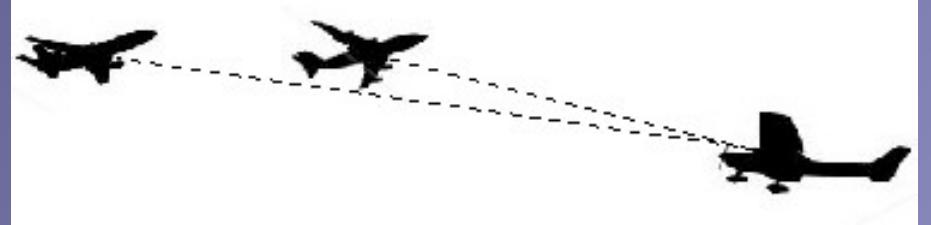
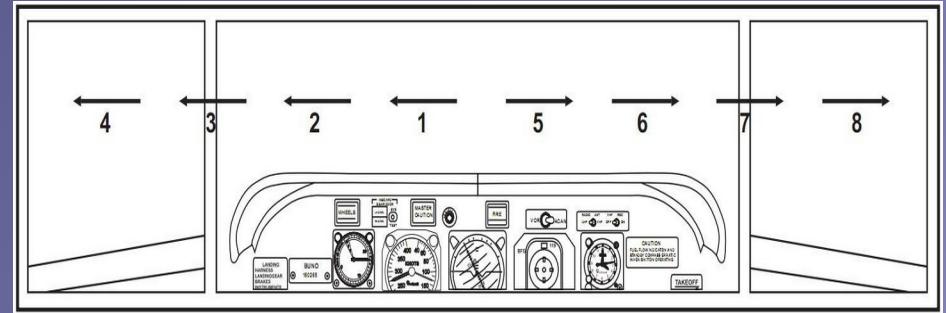
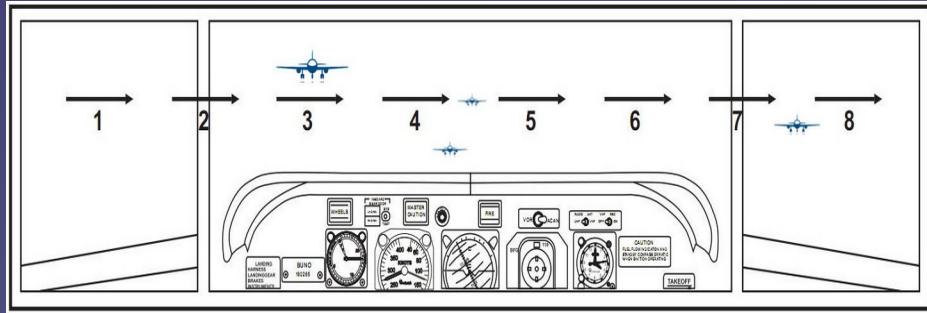
Movements - Yawing



- **Yawing** is a rotational movement about the **vertical** (normal) axis
- Yawing changes the **heading** of the aircraft (left, right)
- Yawing is primarily controlled with the **rudder** pedals
- **Coordinated flight** is desired in *most* situations (kick and center the ball)
- Real and indicated heading change (**heading indicator**, **turn coordinator**)



Lookout



- **Conflicts:**
 - Head-On, Converging, Climbing, Descending
- **Blind Spots:**
 - Below the Aircraft (above and behind depending on the cockpit)
- **Scanning:**
 - Side to Side, Middle to Side



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Control Transfer



- Instructor: “*You have control*”, Student: “*I have control*”
- Instructor: “*I have control*”, Student: “*You have control*”



Summary / Quiz

- What types of aircraft attitudes exist?
- What is the main reference for the aircraft attitude outside and inside the cockpit?
- How does this reference appear from inside the cockpit for different attitudes?
- What is the range of *normal* attitudes?
- What kinds of control inputs and movements change the aircraft attitude and which way?
- How do flight instruments indicate attitudes and movements?
- What movement changes the heading of the aircraft?
- How can scanning be performed to avoid conflicts?



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 Attitudes and Movements
- Flight Instructor Guide – Exercise 5, Lesson Plan 2



Reasons for Yawing

- Aileron Drag / Adverse Yaw
- Gyroscopic Precession
- Torque
- Slipstream
- Asymmetric Thrust

