2025-05-21 - HPL Lecture 2

> Date & Time: 2025-05-21 19:29:05
> Location: [Insert Location]
> [Insert Title]
> `Visual Approach` `PAPI Lights` `Collision Avoidance`

Theme

This lecture covers essential visual approach techniques for pilots, including the use and interpretation of PAPI lights, selecting and maintaining runway aiming points, and managing visual illusions during landing such as the black hole effect and haze. It also addresses collision avoidance principles, including the constant bearing rule, visual scanning methods like the block method, radio communication procedures for traffic awareness, and the impact of human perception and memory on flight safety. Practical examples and considerations for various scenarios, including night and hazy conditions, are discussed to enhance pilot situational awareness and safety.

Takeaways

1. PAPI lights and their function in indicating glide slope, including interpretation of red and white light combinations.
2. Visual approach techniques when PAPI/BASI lights are unavailable, requiring pilots to visually judge their approach using runway markings and windscreen references.
3. Aiming point selection on runway (thousand foot markers) and the use of a fixed reference point on the windscreen to maintain a stable approach.
4. Visual illusions during landing, including the black hole effect at night, haze-induced distance misjudgment, and illusions caused by runway width or length.
5. The principle that constant bearing equals constant danger in collision avoidance, emphasizing the need for vigilance and course alteration.
6. Block method for visual scanning in the cockpit, systematically dividing the view into sections to search for traffic.
7. Radio communication procedures for traffic awareness, including announcing position and intentions, and requesting traffic reports, especially near airfields.
8. Summary of visual checks before entering or crossing runways, and additional checks when climbing, turning, or descending.
9. Quiz questions on visual illusions, runway illusions, and human perception, including memory types and their relevance to pilot perception.

10. Memory types and their relevance to pilot perception, such as sensory memory duration and semantic memory.

Highlights

- `"Constant bearing equals constant danger."-- Speaker 1`
- `"Using something like this marker technique can help you gauge your approach. As you move on, though, you should be able to judge your glide by much more natural means."-- Speaker 4`

Chapters & Topics

PAPI Lights and Visual Glide Slope Indication

> PAPI (Precision Approach Path Indicator) lights are a set of four lights installed at aerodromes to help pilots visually determine if they are on the correct glide slope during approach. The color combination of the lights (red and white) indicates whether the aircraft is too high, too low, or on the correct approach path.

- **Keypoints**
  - Four lights: three red = too low, three white = too high, two of each = correct glide slope.
  - Commonly installed at aerodromes like Logronia and Burgos.
  - If PAPI lights are not available, pilots must visually judge their approach using runway markings and aiming points.
- **Explanation**
  If the aerodrome lacks PAPI lights, pilots must use visual cues to determine if they are approaching the touchdown mark correctly. Instructors may use videos or practical demonstrations to teach this, but ultimately pilots must learn to judge visually, especially since PAPI lights may not be visible during the day.
- **Examples**
  > If a pilot sees three red lights and one white, they are too low on approach. If they see three white and one red, they are too high. Two red and two white means the approach is correct.

  - Observe the color pattern of the PAPI lights.
  - Adjust the approach path accordingly: increase altitude if too low, decrease if too high.
  - Aim to maintain two red and two white lights during approach.
- **Considerations**
  - PAPI lights may not be visible during the day.

    - Pilots must learn to visually judge the approach in the absence of PAPI lights.
- **Special Circumstances**
    - If PAPI lights are not visible or unavailable, use visual aiming points on the runway and adjust approach based on visual cues.

Visual Approach Techniques and Aiming Point Selection

> When PAPI or BASI lights are unavailable, pilots must select an aiming point on the runway, typically the thousand foot markers (the beginning of the two wide white bars), and use visual references on the windscreen to maintain a stable approach.

- **Keypoints**
    - Aiming for the thousand foot markers (two wide white bars) is standard on long enough runways.
    - Use a fixed point on the windscreen as a reference, which may vary depending on aircraft, weight, and conditions.
    - The aiming point should remain stationary relative to the chosen spot on the windscreen; objects before the aiming point appear to move downward, after the point move upward.
- **Explanation**
  Pilots can use a marker or visual reference on the windscreen (such as above the second air vent or two fingers above the compass) to align with the aiming point. The goal is to keep this point fixed on the thousand foot marker. Adjust power and pitch to maintain airspeed and keep the aiming point stationary. The actual touchdown will occur beyond the aiming point due to speed bleed-off during round out.
- **Examples**
  > A pilot places a sticker or uses a visual reference (e.g., two fingers above the compass) on the windscreen to align with the thousand foot marker on the runway.

    - Identify the aiming point on the runway.
    - Select a corresponding point on the windscreen.
    - Maintain the aiming point stationary on the windscreen during approach.
    - Adjust power and pitch as needed.
    - During the round out, the aircraft will touch down beyond the aiming point, as speed is reduced to near stall.
- **Considerations**
    - The reference point on the windscreen varies with aircraft, weight, and conditions.
    - Practice is required to develop natural judgment; instructors may initially use marker techniques, but pilots should progress to natural visual judgment.

- **Special Circumstances**
  - If the runway is long enough, always aim for the thousand foot markers.
  - If conditions change (e.g., wind, weight), adjust the reference point accordingly.

Visual Illusions During Landing

> Pilots may experience visual illusions during approach and landing, especially at night or in poor visibility. These include the black hole effect, haze-induced distance misjudgment, and illusions caused by runway width or length.

- **Keypoints**
  - Black hole illusion: At night, with dark and featureless surroundings, pilots may fly too low and land short of the runway.
  - Haze illusion: Objects at the limit of visibility appear further away than they are, leading to underestimation of proximity.
  - Wide runway illusion: Pilot feels too low, may increase altitude unnecessarily.
  - Narrow runway illusion: Pilot feels too high, may decrease altitude.
- **Explanation**
  At night or in haze, visual cues are diminished, leading to misjudgment of altitude and distance. Pilots must rely on instruments and training to counteract these illusions. Runway width and length can also distort perception, causing pilots to deviate from the correct glide path. For example, a wide runway can make a pilot feel too low, prompting an unnecessary increase in altitude, while a narrow runway can make a pilot feel too high.
- **Examples**
  > During night flying in Burgos, the runway lacked center lights, making it difficult to judge the centerline and increasing the risk of landing short.

  - Approach is flown with only outer runway lights visible.
  - Pilot may misjudge altitude and land before the runway.
  - In haze, mountains or obstructions may appear further away and suddenly loom up, increasing risk.
  - Instructor guidance and practice are essential to mitigate risk.
- **Considerations**
  - Always fly in visual meteorological conditions when possible.
  - Be aware of illusions and compensate using instruments and training.
- **Special Circumstances**
  - If approaching a runway at night with no center lights, be extra vigilant for the black hole illusion.
  - In hazy conditions, assume objects are closer than they appear and adjust approach accordingly.

Collision Avoidance: Constant Bearing Equals Constant Danger

> If two aircraft maintain a constant bearing and course relative to each other, there is a risk of collision. This principle is crucial for visual collision avoidance.

- **Keypoints**
  - Constant bearing with no relative movement indicates collision course.
  - If aircraft move relative to each other, collision is unlikely.
  - Accidents can occur if pilots do not alter course.
- **Explanation**
  Pilots must be vigilant for other aircraft on a constant bearing, especially during approach and in busy airspace. Visual detection can be difficult, especially with background lights or at night. Communication and systematic scanning are essential to avoid collisions.
- **Examples**
  > A helicopter crossed the final approach path while an airplane was turning to final, both on constant bearing, resulting in a collision.

  - Both aircraft maintained constant course and bearing.
  - Lack of visual detection and course alteration led to collision.
  - Even with navigation lights, aircraft can be hard to see against city lights.
- **Considerations**
  - Visual detection of other aircraft can be difficult, especially with background lights or at night.
  - Use block method and radio communication to enhance situational awareness.
- **Special Circumstances**
  - If another aircraft is on a constant bearing, alter course or altitude to avoid collision.

Block Method for Visual Scanning

> The block method involves dividing the cockpit view into sections and systematically scanning each section for traffic, spending two to five seconds per section.

- **Keypoints**
  - Divide cockpit view into blocks.
  - Scan each block for two to five seconds.
  - Repeat for all sections to ensure thorough search.
- **Explanation**
  This method increases the likelihood of detecting other aircraft, especially those that are small or moving slowly relative to the observer. The pilot should scan from up to down, then down to up, covering all sections of the cockpit view, before moving to the next window or door.

- **Examples**
  > A pilot scans from up to down, then down to up, covering all sections of the cockpit view, before moving to the next window or door.

  - Systematic scanning prevents missing traffic.
  - If no traffic is sighted, proceed to the next section.
  - Combine with radio communication for maximum safety.
- **Considerations**
  - Do not rely solely on random glances; use systematic scanning.
  - Combine visual scanning with radio calls for best results.
- **Special Circumstances**
  - If unable to visually confirm traffic, use air-to-air frequency (123.450) to request position reports.

Radio Communication Procedures for Traffic Awareness

> Pilots should use air-to-air and operations frequencies to communicate their position, intentions, and to request information about other traffic, especially when approaching or operating near airfields.

- **Keypoints**
  - Announce position, intentions, and visual reporting points.
  - Request traffic reports from other aircraft.
  - Confirm safe distance before entering traffic patterns.
- **Explanation**
  Effective communication reduces the risk of mid-air conflicts, especially in uncontrolled airspace or when multiple solo students are flying. Pilots should announce who they are, where they are coming from, and at which visual reporting point they will enter the airfield. If unsure of other traffic's position, delay entry into the pattern until confirmation is received.
- **Examples**
  > A pilot announces their position and intentions on both air-to-air and operations frequencies, requests traffic reports, and confirms safe distance before joining the downwind leg.

  - Announce who you are, where you are coming from, and entry point.
  - Request other traffic to report their positions.
  - Confirm safe separation before entering pattern.
  - If another aircraft is performing touch-and-goes, wait until it is safe before joining the pattern.
- **Considerations**
  - Always communicate when approaching busy airfields.

    - Solo students are at higher risk and should be especially vigilant.
- **Special Circumstances**
    - If unsure of other traffic's position, delay entry into pattern until confirmation is received.

Summary of Visual Checks Before Entering or Crossing Runways

> Pilots must visually check both directions before entering or crossing runways, even if believed to be inactive. Additional checks are required when climbing, turning, or descending.

- **Keypoints**
    - Check both sides of runway before entering/crossing.
    - Check under aircraft nose when climbing.
    - Look in direction of intended turn before turning.
    - Check beneath before descending.
- **Explanation**
  These checks help prevent runway incursions and mid-air conflicts, especially in uncontrolled airspace. When climbing, pitch down slightly to check below; before turning, look in the direction of the turn; before descending, pitch down to check for traffic below.
- **Examples**
  > Before entering a runway, a pilot visually checks both directions, ensures no aircraft are approaching, and only proceeds when the approach path is clear.

    - Visually confirm no traffic is on final or taking off.
    - Check both sides, especially at airports with crossing runways.
    - Proceed only when safe.
- **Considerations**
    - Be especially vigilant around airfields, visual reporting points, low-level corridors, radio navigation beacons, or other bottlenecks.
    - ATC will provide instructions in controlled airspace.
- **Special Circumstances**
    - If visibility is limited, use radio communication to supplement visual checks.

Visual Illusions: Runway Width and Length Effects

> The perceived width and length of a runway can create illusions that affect a pilot's approach. A wider than normal runway makes the pilot feel too low, while a narrower runway makes the pilot feel too high. A smaller runway may appear further away than it actually is.

- **Keypoints**

    - Wide runway: pilot feels too low, may increase altitude.
    - Narrow runway: pilot feels too high, may decrease altitude.
    - Shorter or smaller runway appears further away than it is, leading to possible overflight.
- **Explanation**
  Pilots must be aware of these illusions and maintain the correct approach path, regardless of perceived altitude. The illusion may cause pilots to overcorrect, leading to unsafe approaches.
- **Examples**
  > When approaching a wide runway, pilots may believe they are too low and increase altitude, leading to a higher than normal approach.

    - When approaching a narrow or short runway, pilots may believe they are too high and decrease altitude, risking a low approach.
    - Recognize the illusion and trust instruments and standard procedures.
- **Considerations**
    - Awareness of illusions is critical for safe landings.
    - Training and experience help pilots recognize and compensate for illusions.
- **Special Circumstances**
    - If approaching a runway with unusual width or length, rely on standard aiming points and instrument references.

Human Perception and Memory in Aviation

> Human perception is based on incoming information and past experience. Visual images persist in sensory memory for approximately one second. Semantic memory is the part of long-term memory concerned with meaning.

- **Keypoints**
    - Visual image persists in sensory memory for about one second.
    - Semantic memory relates to meaning and understanding.
    - Human perception is influenced by both current input and prior experience.
- **Explanation**
  Understanding the limitations and characteristics of human perception and memory helps pilots anticipate and mitigate errors caused by illusions or misinterpretations. Quiz questions addressed these topics, such as the duration of sensory memory and the definition of semantic memory.
- **Examples**
  > Quiz included questions about the duration of sensory memory and the definition of semantic memory.

    - Sensory memory lasts about one second.

    - Semantic memory is concerned with meaning.
    - Human perception is based on both incoming information and past experience.
- **Considerations**
    - Pilots should be aware of the limitations of human perception.
    - Training should reinforce correct interpretation of visual cues.