



Nerd Out On PAPI's

Really???


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PAPI(pap-ih)

Definition:
(Precision Approach Path Indicator)

A navigational aid that assists pilots to visually recognize the accuracy of their glidepath in reference to the runway's touchdown zone. Thus, allowing them to make minor corrections as needed in the visual landing phase of flight.

Ben's definition!! Not found in the Websters dictionary.



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NERD

Definition:

1:
a person who is extremely enthusiastic and knowledgeable about a particular subject, especially one of specialist or niche interest:

2:
an unstylish or socially awkward person

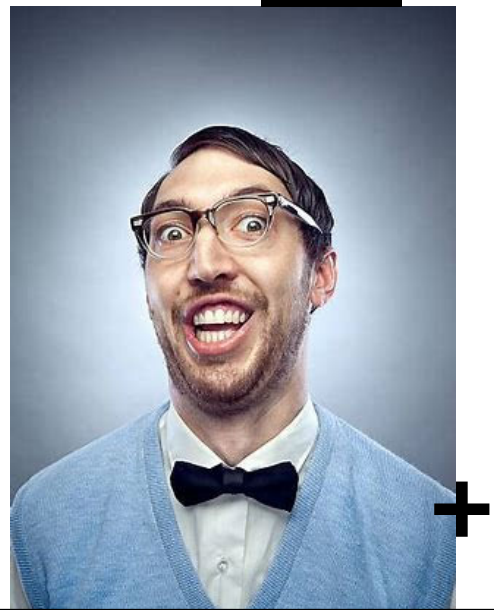


DRYBAR

Nerd Or Geek

DON McMILLAN

Now that we
understand the session
title



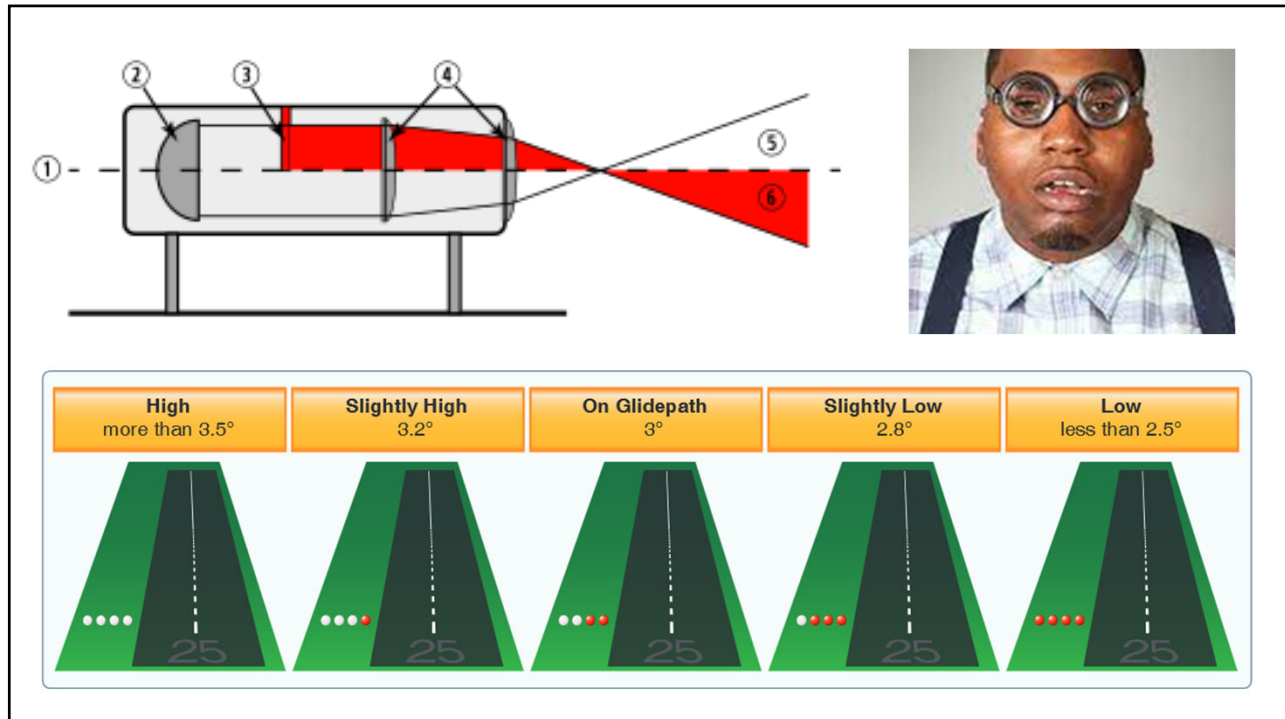
How It Works

A light beam is focused through a red filter and aimed to at a coordinated angle so from the perspective of the observer it looks red or white.

If on a 4 box PAPI system you are seeing 3 white... the indication is your perspective is higher than GS

If on a 4 box PAPI system you are seeing 3 red... the indication is your perspective is lower than GS

If 2 white and 2 red you are on the glide path



Maintenanc

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What to do.

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–The FAA Advisory Circular 150/5340-26C establishes maintenance intervals for PAPI lights and provides direction to maintenance crews on how often PAPI lights and their components need to be checked.



Table 5-9. Preventive Maintenance Schedule for PAPI (Precision Approach Path Indicator)

Maintenance Requirement	D A I L Y	W E E K L Y	M O N T H L Y	Q U A R T E R L Y	S E M I A N N U A L	A N N U A L	U N S C H E D
1. Check lamps for operation.	X						
2. Check operation of controls.		X					
3. Check for damage by service vehicles or aircraft.		X					
4. Clean lamps and filters.		X					
5. Check mechanical parts for damage.		X					
6. Check lightning arresters.		X					
7. Check for water damage or insect infestation.		X					
8. Check for presence of rodents.		X					
9. Record output current and input voltage of adapter (if used).		X					
10. Check alignment and aiming of light boxes.			X				
11. Check leveling and operation of tilt switch.			X				
12. Check integrity of obstacle-free approach plane.				X			
13. Check insulation resistance of underground cables.					X		
14. Check resistance of grounding system.					X		





Precision Approach Path Indicators (PAPI)




Maintenance Requirement	Interval						Satisfactory	Unsatisfactory	Recordings /Notes
	Daily	Weekly	Monthly	Semi-Annual	Annual	Unscheduled			
Lamp Operation	X								
Operation of Controls			X						
Damage By Service Vehicles or Aircraft			X						
Clean Lamps and Filters			X						
Check Mechanical Parts for Damage			X						
Lightning Arresters			X						
Water Damage or Insect Infestation			X						
Check for the Presence of Rodents			X						
Check Alignment and Aiming of Lightboxes			X						
Check Leveling and Operation of Tilt Switches			X						
Check Integrity of Obstacle-Free approach Plane					X				
Insulation Resistance of Underground Cables						X			
Resistance of Grounding System						X			

If an airport's PAPIs are not being periodically checked, they can begin to stray from their intended angles. When PAPI lights stray from their intended angles, they could give bad information to a pilot on final approach




$\theta = \tan^{-1} \left[\frac{\text{Height}}{\text{Distance}} \right]$

How to check your angle?



Airport



Ben Mehin
Neo Electrical Solutions
(612)866-6776

05 PAPI Flight Check Log

Date: _____

Aggregate Glide Slope: _____ degrees Arch/minutes

Desired Side Slope +/- 0.2 Degrees: 3 3.00

Box #	Desired Aiming Angle		Flight Check Angle	Recorded Angle on Box	
	degrees	Arch/minutes		degrees	Arch/minutes
Box 1	3.50	3.30'	3	2.60	
Box 2	3.17	3.10'			
Box 3	2.83	2.50'			
Box 4	2.5	2.30'			

Degrees Adjustment	Box #	Distance from Box	Height B
-0.40	1	150	9.174
0.00	2	100	5.538
0.00	3	100	4.943
0.00	4	100	4.966

23 PAPI Flight Check Log

Date: _____

Aggregate Glide Slope: _____ degrees Arch/minutes


Desired Side Slope +/- 0.2 Degrees: 3.00 3.00

Box #	Desired Aiming Angle		Flight Check Angle	Recorded Angle on Box	
	degrees	Arch/minutes		degrees	Arch/minutes
Box 1	3.50	3.30'			
Box 2	3.17	3.10'			
Box 3	2.83	2.50'			
Box 4	2.5	2.30'			

Adjustment	Box #	Distance from Box	Height B
0.00	1	150	9.17499302
0.00	2	100	5.5384597
0.00	3	100	4.9430241
0.00	4	100	4.96609429

Decimal Degrees	Minutes	Decimal Degrees	Minutes
0.02	1	0.52	31
0.02	2	0.53	32
0.05	3	0.55	33
0.07	4	0.57	34
0.08	5	0.58	35
0.1	6	0.6	36
0.12	7	0.62	37
0.13	8	0.63	38
0.15	9	0.65	39
0.17	10	0.67	40
0.19	11	0.68	41

Parameter	Standard	Tolerance/Limit: Initial	Tolerance/Limit: Operating
Lamps Burning	ALL	ALL	-1 per box
Vertical Aiming			
Unit D (closest to runway)	3 degrees 30 min	+/- 2 minutes	+/- 6 minutes
Unit C	3 degrees 10 Mm	+/- 2 minutes	+/- 6 minutes
Unit B	2 degrees 50 min	+/- 2 minutes	+/- 6 minutes
Unit A (farthest from runway)	2 degrees 30 min	+/- 2 minutes	+/- 6 minutes
Horizontal Alignment	Parallel to runway	+/- 1/2 degree	+/- 1/2 degree
Tilt Switch	1/4" below, 1/2" above	same as standard	same as standard
Lamp Current (Amp-regulated)	Rated current of lamp	same as regulator used	same as regulator used
Lamp Voltage (Volt-regulated)	Rated voltage of lamp	+/- 3%	+/- 3%
Obstructions due to Vegetation	NONE	NONE	NONE





Mark Your Angles

- You need a reference for the angle
- How do you know if your angle is correct?

- Inside the cover
- By placard or brass tag
- In a O&M manual

Issues:

What to look for



Gaskets

- Dust and debris
- Moisture on a lens
- Frost



Critters

- Evidence of rodent damage
- Block openings with duct seal or screen
- Inspect latches and hasps
- BUGS!



Outage – UH OH

- LOTO – Lock out tag out before opening
- Smell for burnt electronics – sometimes not noticeable by sight
- Phoenix connectors – Loose connections



Safety

Lock Out Tag Out

- Turn off power to your system – PAPI
- Lock out
- Tag out
- Return to service when ready

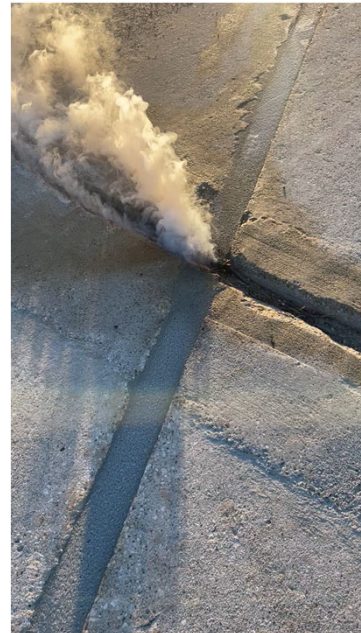


Short Circuit



- Actual footage of a runway failure!

- Problem? Yes
- What is happening?
- Can this type of failure be prevented? – Sometimes
- This type of failure is potentially damaging to other places in the circuit
- Who took the video? Hmm... IDK but, he/she is too close for comfort!

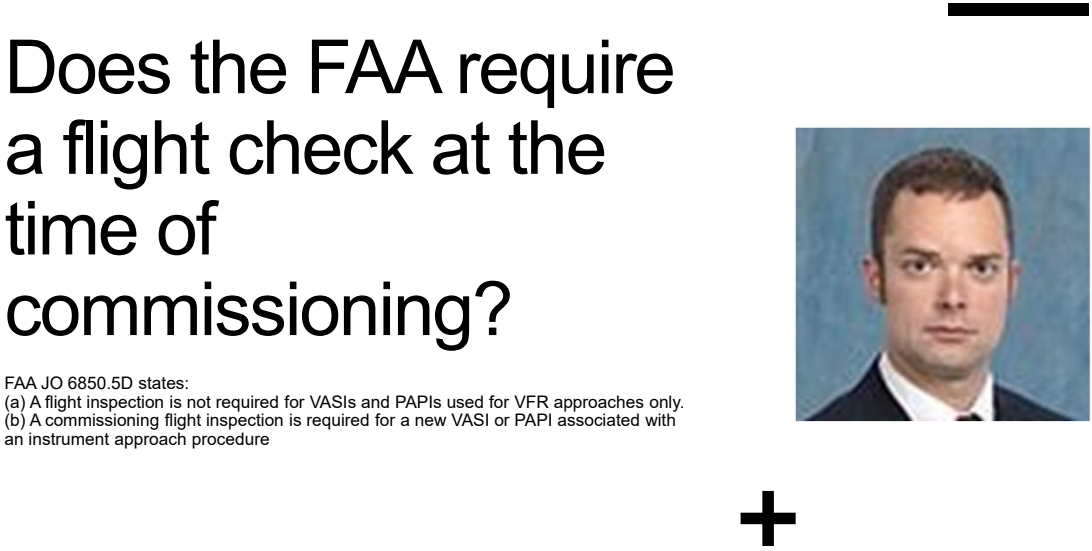




Questions?

Does the FAA require a flight check at the time of commissioning?

FAA JO 6850.5D states:
(a) A flight inspection is not required for VASIs and PAPIs used for VFR approaches only.
(b) A commissioning flight inspection is required for a new VASI or PAPI associated with an instrument approach procedure



What causes PAPI systems to fall out of adjustment and shut off?



PAPI systems can come out of adjustment for any number of reasons. Obviously, any time that anyone accidentally strikes a PAPI fixture with a mower or snowplow, there is a large risk of knocking them out of adjustment. In Minnesota, the most common need for an adjustment is the mere fact that the ground moves a lot in our state. The freeze-thaw cycles can move concrete piers that are large and deep in the ground



What is the proper procedure for checking angles and adjusting PAPIs?



The best advice for adjusting PAPIs is to not make adjustments unless you are sure that you understand the process. Take the time to read through the manufacturer's adjustment method so that you perform the adjustments properly. Alignment methods differ from brand to brand. For the most part, the instructions are available online at the click of a mouse. If you follow the manufacturer's procedure, you will have the PAPI fixtures aligned properly in short order.





An experienced pilot has stated that the PAPIs “seem off.” Does the pilot know what they’re talking about?

Input from pilots should never be ignored. Pilots use many different instruments, and their years of flight experience preparing to land their aircraft are invaluable. Anytime a pilot provides feedback about how your airport’s PAPI system is operating, take your alignment equipment out and check it all out. Remember that the next pilot might be relying on the accuracy of the PAPI for their landing.



Any advice for airport managers?

MnDOT encourages all airport managers to take their PAPI aiming equipment out and measure the angles of their airport’s PAPI fixtures. However, don’t plan to make any adjustments until you are aware of the process; but do try out the equipment, and as questions arise, learn. The practical experience gained will provide understanding of the equipment and some insight into what is required when it’s time to realign those angles.

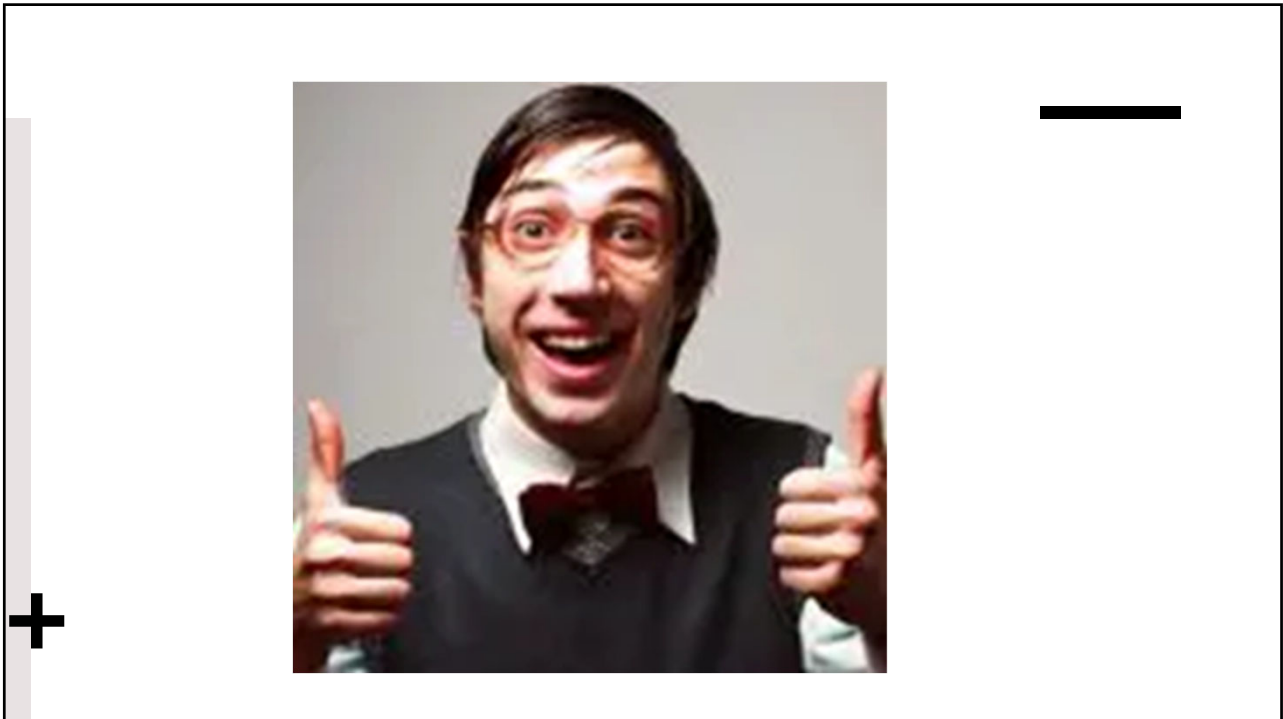


For PAPIs with associated instrument approach procedures, are the PAPIs ever required to be flight checked again after the initial commissioning has been carried out?

The short answer is, "yes." FAA JO 6850.5D specifies several reasons that a restorative flight check would be required. A couple (but not all) of the reasons for a restorative flight check would be:
(a) When a PAPI fixture has been physically relocated.
(b) When the reference angle is changed due to an obstruction. An example would be a construction crane at a nearby jobsite which infringes into a clearance area.









Thank you!

Nerd out on PAPI's Casey Carlson – Ben Melin