



TEST YOURSELF!

We offer you to test yourself by taking one of the tests offered to pilots who use «direct» attitude indicator during the study of the spatial orientation peculiarities.

The test consists of two steps: 1 – draw 10 pictures of directions and rates of roll and pitch in «direct» indication, 2 – define the direction and rate of roll on the given images. In both cases calculate how much time you spent on the test. According to the requirements of the Advisory Circular AC No:25-11, a pilot must recognize the spatial position of the aircraft and start the aircraft recovering to horizontal flight within 1 second.

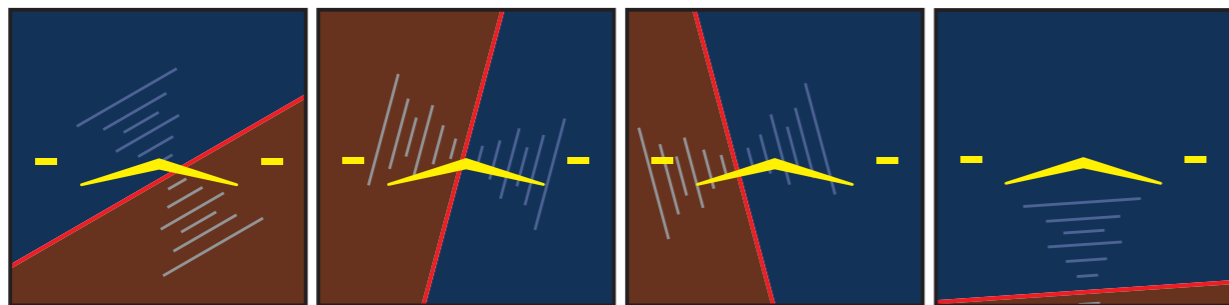
STEP 1. DEPICTION OF THE SPATIAL ORIENTATION

Draw an image of «direct» attitude indicator for each of the following aircraft positions:

	ROLL	PITCH
1	left 70°	up 25°
2	left 75°	up 13°
3	left 110°	up 3°
4	left 120°	down 20°
5	right 90°	up 12°
6	right 100°	up 7°
7	right 115°	down 3°
8	right 170°	down 40°

STEP 2. SPATIAL ORIENTATION

Find the rate and the direction of roll and pitch, as well as specify the direction the aircraft should be guided to gain horizontal position for each of the following pictures of «direct» attitude indicator (*images are specially given without auxiliary scales and digital indicators*).

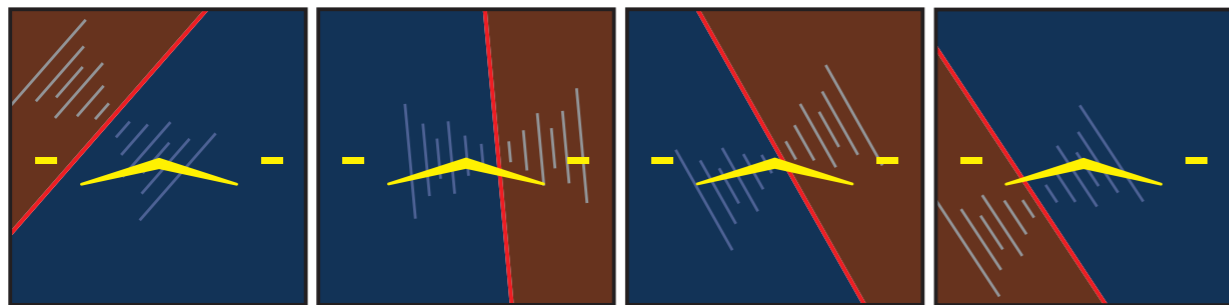


1.

2.

3.

4.



5.

6.

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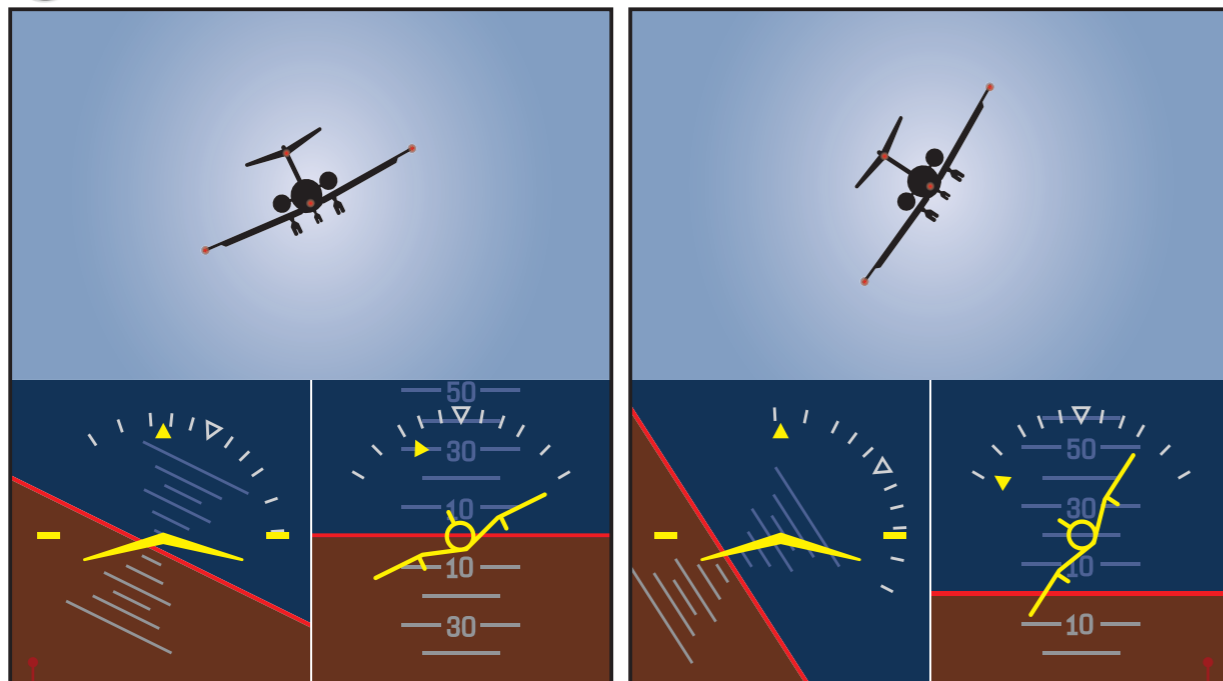
FRONTLINE AVIONICS LLC.
HAVLOVSKA 33, PRAGUE,
CZECH REPUBLIC
+420 773078426

WWW.GLANCE-EFIS.COM
INFO@GLANCE-EFIS.COM



«DIRECT» AND «INDIRECT» ATTITUDE INDICATOR

WHAT DOES «INDIRECT» ATTITUDE INDICATION MEAN?



«**DIRECT**» ATTITUDE INDICATOR DISPLAYS A MOVING HORIZON WHILE THE AIRCRAFT IS FIXED (AS SHOWN ON THE LEFT PARTS OF BOTH PICTURES).

«**INDIRECT**» (OR «**OUTSIDE-IN**») ATTITUDE INDICATOR DISPLAYS A MOVING AIRCRAFT WHILE THE GROUND IS FIXED (AS SHOWN ON THE RIGHT PARTS OF BOTH PICTURES)

WHAT IS SAFER TO USE: «DIRECT» OR «INDIRECT» ATTITUDE INDICATOR?

In the 1970s – 90s the Soviet Union conducted large-scale study what flight image civil and military pilots have, as well as people who never piloted a plane.

In different groups tested persons defined their flight image the following way:

TESTED GROUPS	FLIGHT IMAGE	
	AIRCRAFT FIXED, HORIZON TILTS	AIRCRAFT TILTS, HORIZON FIXED
Pilots who use «indirect» attitude indicator	35 %	65 %
Non-pilots	70 %	30 %
Pilots who use «direct» attitude indicator	49 %	51 %
Present-day civil pilots	65 %	35 %

The results of the test on defining unusual attitudes and recovering from them were the following:

CRITERIA	MISTAKES WHEN DEFINING SPATIAL ORIENTATION	
	USING «DIRECT» ATTITUDE INDICATOR	USING «INDIRECT» ATTITUDE INDICATOR
Roll depiction	19 %	0 %
Pitch depiction	15 %	0 %
Roll defining	13 %	3 %
Pitch defining	9 %	2 %
Roll-out	16 %	3 %
Pitch recovery	9 %	2 %

The overall conclusion of the study stated that from the point of view of safety it is advisable to use «indirect» attitude indicator for maneuverable aircrafts.

The studies conducted in the USA also demonstrated the superiority of using «indirect» attitude indicator when recovering an aircraft from unusual attitudes. According to the studies this superiority is based on the physiological patterns of human brain (see Previc. The neuropsychology 3-D space, American Psychological Bulletin 124, 123-164. 1998).

William R. Ercoline, D.Eng., a famous American research-pilot, performed analysis of the US Air Force aircrafts crashes during 1971 – 2000 related to spatial disorientation. The study stated that 82 US Air Force pilots crashed during last 15 years, which is 20% of all A-class accidents. The cost of the crashed aircrafts was equal to 1,9 billion dollars. In Russia during 1989 – 2008 10 aircrafts crashed due to spatial disorientation when using «direct» attitude indicator. The loss of aircrafts equaled to 3 transport helicopters and 7 civil airplanes.

NO PLANE CRASHES DUE TO SPATIAL DISORIENTATION WHEN USING «INDIRECT» INDICATION WERE REGISTERED IN THE USSR AND RUSSIA FOR THE ENTIRE PERIOD OF OPERATION.

IS «INDIRECT» INDICATION GOOD FOR ME?

Yes! «Indirect» indication is natural for human perception. When training using «indirect» indication 100% of students – Air Force pilots cope with instrument flying, and when using a «direct» indication 35% of the students are unable to cope with it at all.

I ALWAYS USE «DIRECT» INDICATION. IS IT SAFE TO SWITCH TO «INDIRECT» ONE?

Yes! The results of the abovementioned research revealed that the pilots who changed spatial orientation from «direct» to «indirect» showed no errors in aircraft roll and pitch depicting and defining.

IS IT LEGAL TO USE «INDIRECT» ATTITUDE INDICATOR?

Yes! In the US certification documentation in 2007 a standard was introduced which allows installing an «indirect» attitude indicator and using it for aircraft recovering from roll and pitch limits and positions out of limits (Advisory Circular AC No:25-11A, adopted by U.S. Department of Transportation Federal Aviation Administration on 21.06.2007). This standard is preserved in the renewed documentation and valid up to date (Advisory Circular AC No:25-11B dated 07.10.2014).

GET THE COMFORT OF «INDIRECT» INDICATION WITH GLANCE EFIS DEVICE BY FRONTLINE AVIONICS!

Glance EFIS device is a full-featured flight, navigation and engine monitoring instruments system for experimental, UL and LSA General Aviation aircrafts and helicopters. Glance EFIS has a unique option – you can switch from «direct» to «indirect» style of attitude indicator! For more information please visit Frontline Avionics website – www.glance-efis.com

