

Astrocompass AK-53 for MSFS2004

version 2.1 from 18.04.2010

2010 (c) Alexander Belov a_belov@mail.ru, freeware

1. Introduction

An astrocompass is a navigational tool for determining the direction of north through the positions of various astronomical bodies.



American-made astrocompass Mk-II

There are certain circumstances when magnetic compasses and gyrocompasses are unreliable. The most obvious is in polar regions, where the force exerted on the needle of a magnetic compass is nearly vertical and gyrocompasses become unstable due to the rotation of the Earth. Magnetic compasses are also particularly susceptible to magnetic fields, such as those produced by the hulls of some metal parts of the aircraft. Before the advent of electronic navigational aids such as GPS the most reliable way to ascertain north in such circumstances was using of an astrocompass.

The only limitation is that any reliably distinguished astronomical body must be visible. So, astrocompass is unusable in clouds, rain, snow, mist, at dusk and dawn.

The Earth's axis of rotation remains stationary throughout the year. Thus, with knowledge of the current time and geographical position in the form of latitude and longitude, which are set on the instrument using dials, an astrocompass can be sighted on to any astronomical object with a known position to give an extremely accurate reading.

In its most basic form, the astrocompass consists of a base plate marked with the points of the compass, with a mechanism known as an equatorial drum mounted on it. A set of adjustable sights and a scale of declination is mounted on this drum. More advanced versions may have built-in chronometers or default settings for bodies such as the Sun.

To use the compass, the base plate is first levelled with the horizon then pointed roughly to what the user believes to be north. The equatorial drum is then tilted according to the local latitude. The sights are then set using the local hour angle and the declination of astronomical body being used. Once all these settings have been made, the astrocompass is simply turned until the astronomical body is visible in the sights: it will then be precisely aligned to the points of the compass.

AK-53 is a Russian astrocompass. Unlike Mk-II astrocompass, AK-53 has two pointing systems. The upper was intended to be used during night, and the lower system was intended to be used in daytime and work with the Sun only. The lower pointing system was connected with clock mechanism, and once tuned, it follows the Sun movement, so the true heading can be obtained constantly.

2. Installation

Copy AK-53v1.cab into the GAUGE folder of MSFS2004 installation.

Add a new sub-panel description in [Window Titles] section of aircraft' panel.cfg file:

```
[Window Titles]
...
WindowXX=Astro Compass
```

where XX – is a new sub-panel number.

Copy following lines:

```
[WindowXX]
Background_color=0,0,0
size_mm=800,600
window_size_ratio=1.000
position=0
visible=0
ident=20
```

```
gauge00=AK-53v1!AK-53v1, 246,8,280,466
```

Here 'XX' should be the same as 'XX' assigned in panel.cfg [Window Titles] section.

3. Description

1 – Latitude mark

2 – latitude ring (red numbers are for the Western hemisphere, white – for Eastern hemisphere)

3 – heading ring

4 – heading pointer

5 – pointing wires of the lower pointing system

6 – Sun “trace” on the screen of the lower pointing system

7 – upper latitude ring (hour angle ring for upper pointing system)

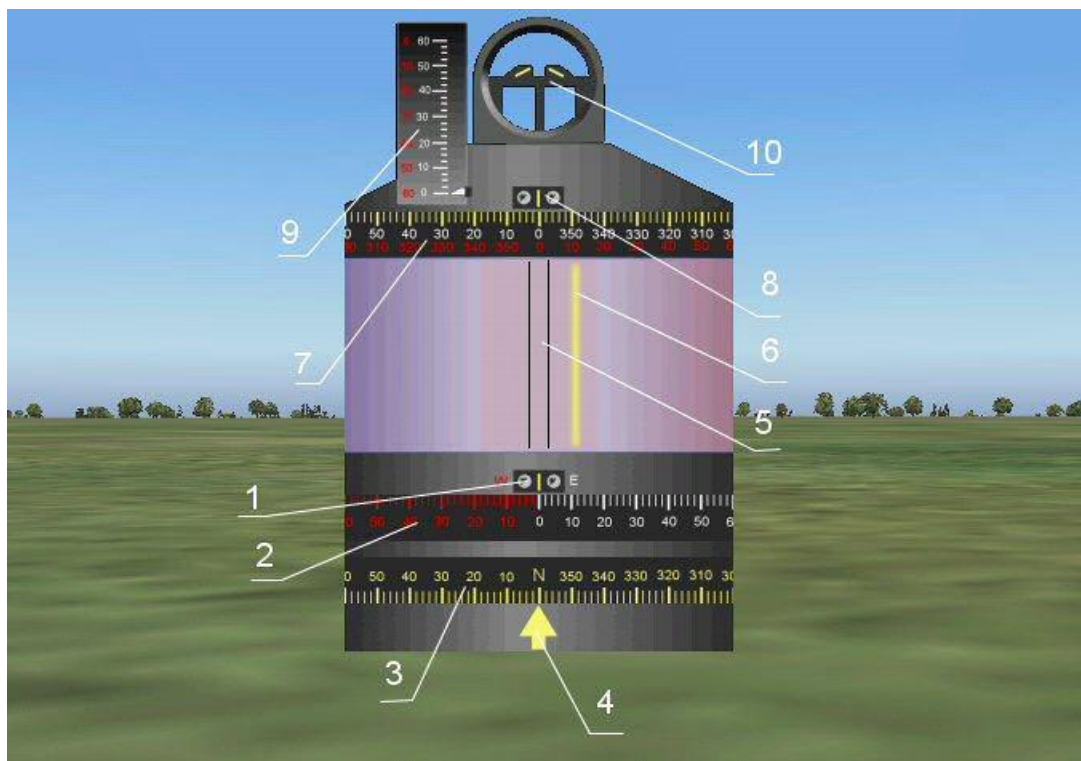
8 – latitude mark for upper pointing system

9 – declination scale

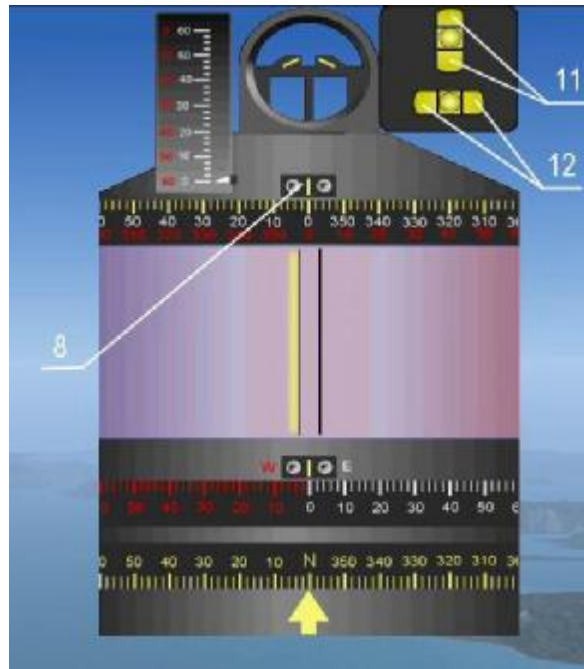
10 – upper pointing system

11 – longitude level click-zones

12 – lateral level click-zones



Astrocompass AK-53 in MSFS2004

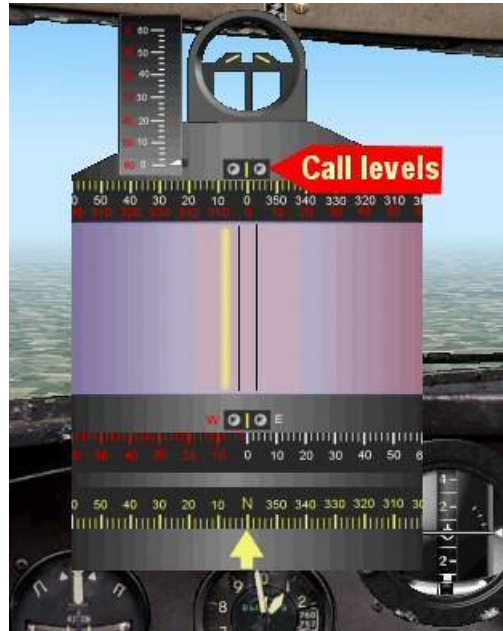


Astrocompass AK-53. Levelling system

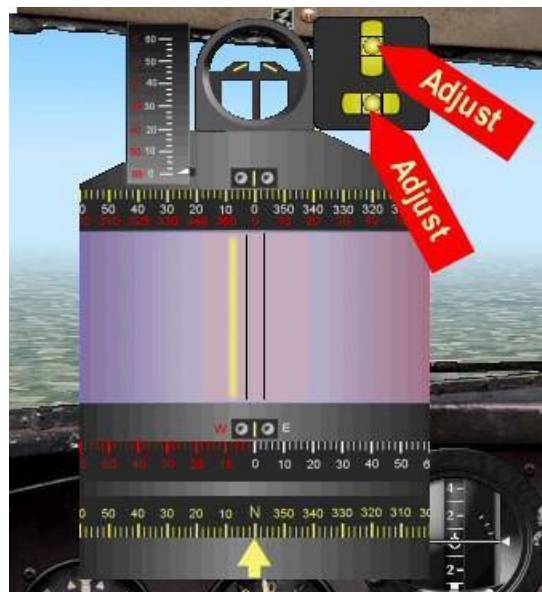
4. Operation

4.1. Setup

Before the measurements begins, astro compass should be first levelled with the horizon. Call the levels panel by clicking the upper latitude mark (8).



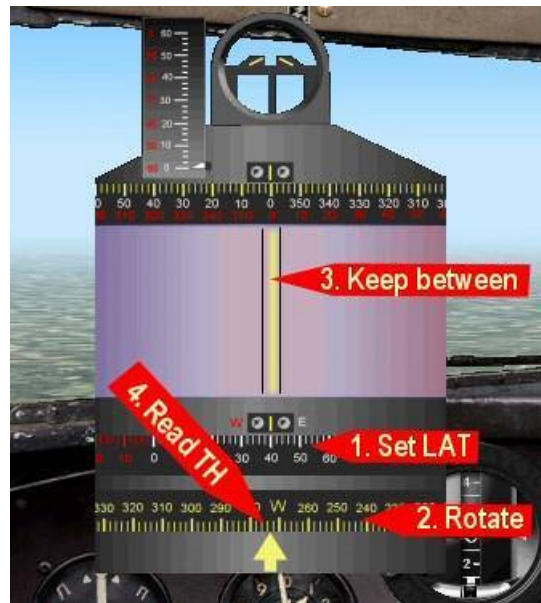
Set the compass' base by clicking on the two levels (11, 12).



Click the upper latitude mark again to hide leveller. Now level can be hidden by clicking the upper latitude mark (8) again. Setup is completed.

4.2 Daylight operation

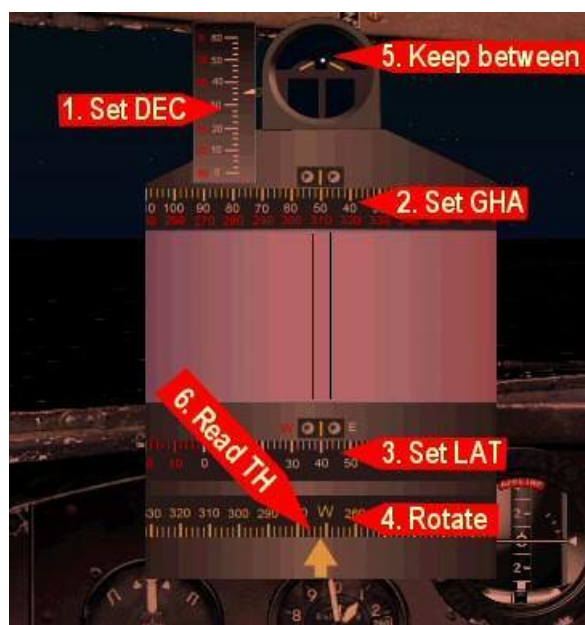
For daylight operations, the knowledge of current latitude (LAT) is necessary. Set the current latitude on the latitude ring (2) against latitude mark (1). Then, rotate heading ring (3) until the Sun trace (6) occurs between pointing wires (5). Read current true heading (TH) against pointer (4)



By clicking on the heading pointer (4) the current heading can be sent to the first directional gyro. Because clock mechanism is constantly working, the Sun trace will stay between pointing wires. Lower pointing system can be used in daytime only and is not operational at dusk and dawn.

4.3 Night operation

For night operations, upper pointing system should be used. Besides current latitude, one needs to select a star and obtain star's Greenwich hour angle (GHA) and declination (DEC).



Set DEC and GHA first, than set LAT and rotate heading ring (3) until the star occurs between pointing wires. By clicking on the heading pointer (4) the current heading can be sent to the first directiona gyro.

Upper pointing system is not connected to the clock mechanism, so one must correct GHA according to Greenwich time.

For more information on the use of celestial navigation aids read following book:

“Air Navigation” Published: Army Air Forces Training Command, circa 1944.

<http://aafcollection.info/items/detail.php?key=198&pkg=ls!viewed!!198!1!viewed!dn!20>

This textbook was used to teach advanced navigation at San Marcos Army Air Field in 1944 and 1945. It is extensively illustrated with diagrams to explain virtually all material covered in the text.