Compass Correction

Celestial procedures can be used to determine compass deviation. This technique is especially advantageous since ground swinging is frequently inconvenient and sometimes inaccurate for a particular type of aircraft. Previously mentioned steps in compensating and swinging the compass remain the same; however, for the sake of simplicity it is assumed that the compensating swing is complete and that the residual deviation must be found.

Perhaps the best method of swinging the compass by celestial means is by the use of the astro-compass. When this instrument is set up correctly, true heading can be read directly. Since the primary object of any compass swing is to find the magnetic heading of the aircraft at any given instant, variation must then be applied to true heading. Deviation can be determined by comparing compass headings to corresponding magnetic headings.

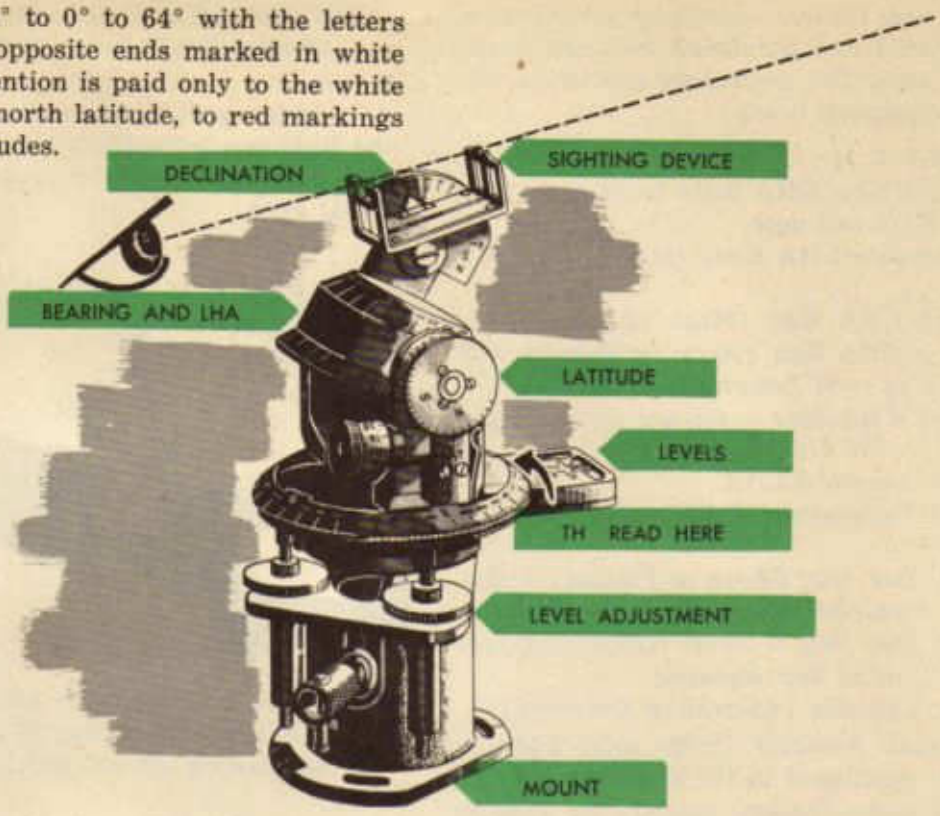
The astro-compass is an instrument designed primarily to determine the true heading of an aircraft. In addition, however, it can be employed to determine true bearing, compass deviation, and to identify a star. In either case the same fundamental principles of operation are followed.

The instrument itself is made up of a leveling device, movable drums, a declination scale, and a sighting device. A mounting device accompanies the astro-compass in order that it can be installed in a turret parallel to the longitudinal axis of the airplane. The actual manipulation of the instrument is fool-proof as long as the directions are followed. For instance, the portion of the mounting base marked "AFT" must be placed toward the tail of the airplane. A slot and keyway arrangement assures the proper insertion of the astro-compass into the base.

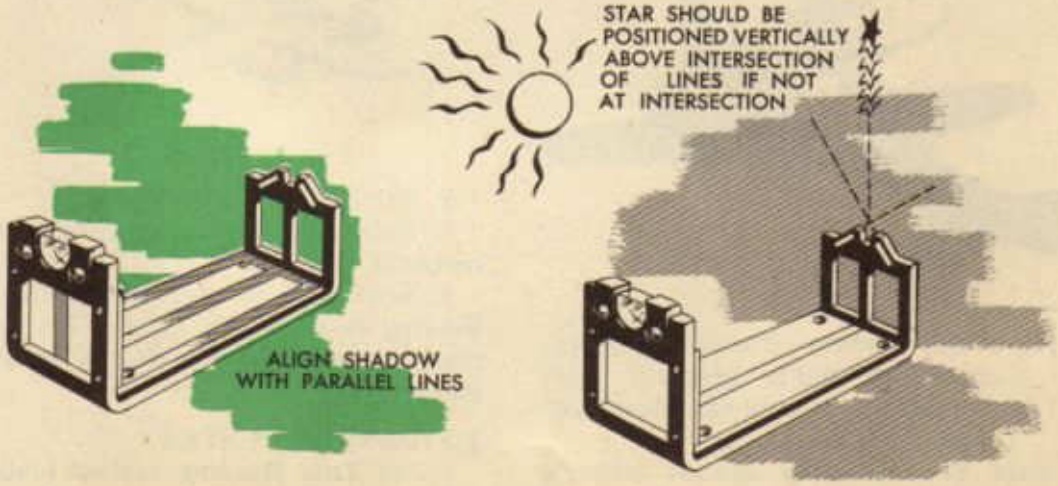
The LHA drum turns about the lateral axis. A dial expressing latitude is connected to a micrometer as well as the drum. The instrument may be used in both hemispheres by following the directions. White numerals are used in north latitudes, and red numerals are used in south latitudes; the 90 is in white only. The knob for setting LHA is opposite the latitude dial. This drum provides a horizon for the instrument.

The declination scale bracket is mounted on top of the astro compass. The scale is

graduated 64° to 0° to 64° with the letters N and S at opposite ends marked in white and red. Attention is paid only to the white markings in north latitude, to red markings in south latitudes.



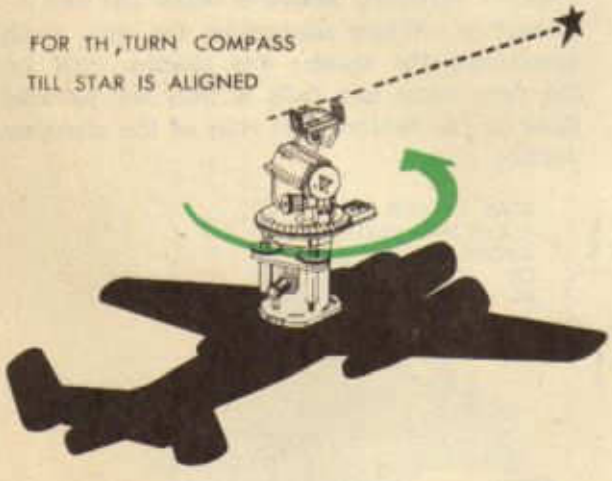
The sighting device is attached to the declination scale bracket. The fore sight is constructed with a shadow bar in the lower area and luminized sight lines at the top. The rear sight is equipped with a lens whose focus is infinity with the fore sight when an object is sighted beyond the fore sight. The rear sight has a translucent screen with two parallel lines to correspond with the fore sight bar. When all settings are accurately made, the star will appear at the intersection of the white lines in the fore sight. This will seldom occur due to slight errors; therefore a star is considered properly positioned when it appears vertically above or below the line intersection. When observing the sun (and sometimes the moon) the shadow cast by the fore sight bar falls within the parallel lines on the bottom and rear of the sighting device.



In all uses the astro-compass must be carefully leveled and paralleled with the longitudinal axis. The remaining procedure follows as indicated below:

TO FIND T H:

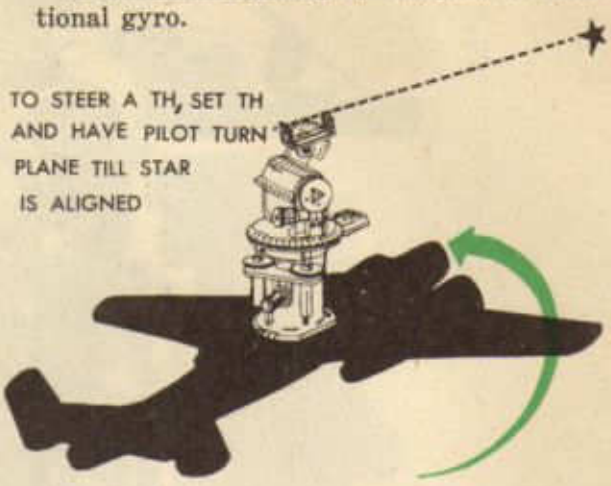
1. Determine GHA Body from Air Almanac for GCT and date.
2. Compute LHA Body (always use LHA West).
   (a) LHA Sun (Moon or Planet) = GHA Sun (Moon or Planet) +E or —W Longitude.
   (b) LHA Star = GHA ♈ + SHA Star —W Longitude.
3. Set computed LHA.
4. Set Declination of Body from Air Almanac.
   (a) Dec. Sun (Moon or Planets) = Extracted against GCT and date.
   (b) Dec. Star = From inside back cover of Air Almanac.
5. Set Latitude (Asumed or Observed).
6. Rotate Azimuth Circle until body is properly positioned in the sights.
   (a) Sun—Shadow appears on shadow screen of Sight.



   (b) Moon, Planets, Stars — Body appears in sights properly positioned. Frequently the Moon will cast a shadow.
7. Read True Heading against lubber's line.

TO STEER A TRUE HEADING:

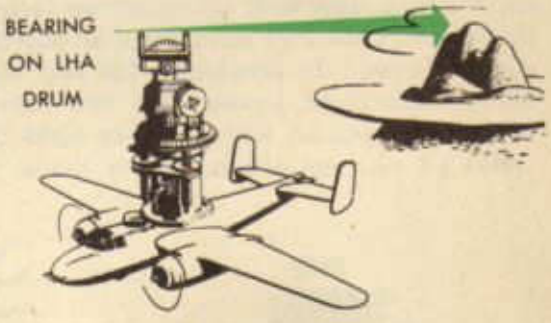
1. Obtain True Heading by the above means.
2. Instruct pilot to turn the airplane until the Body can be properly sighted.
3. Maintain heading by compass or directional gyro.



4. Check heading with astro-compass at intervals of not more than 15 minutes, altering the heading steered on the gyro if necessary.

TO OBTAIN THE RELATIVE BEARING AT A DISTANT OBJECT:

1. Set 360° (N) against True Heading lubber's line.



2. Set Latitude scale at 90°.
3. Rotate LHA scale until object appears correctly in sights.
4. Read relative bearing against True Bearing datum mark. (Note: True Bearing results when True Heading is set opposite lubber line.)

TO IDENTIFY A STAR:

1. Set True Heading against lubber line.
2. Set Latitude.

3. Rotate LHA scale and adjust sights until star appears in sights at intersection of lines.

4. Read Declination and LHA of star on respective scales.

5. Extract GHA ♈ against GCT and Date from Air Almanac.

6. Determine SHA star by: SHA = LHA★ —E or +W Long. — GHA ♈.

7. Extract name of Star from inside back cover of Air Almanac against SHA and Declination.

TO DETERMINE COMPASS DEVIATION:

1. Determine True Heading of aircraft as usual.

2. Apply variation to obtain Magnetic Heading.

3. Read Compass Heading at time of determining True Heading.

4. Compass Heading minus Magnetic Heading is deviation.

In addition to the astro-compass, the drift-meter and shadow pin may be used to determine compass deviation. Unlike the astro-compass, which provides true heading directly, these instruments provide, directly or indirectly, a relative bearing of the celestial body from the aircraft.

The azimuth of a celestial body is used as a basis for this method. True azimuth, measured clockwise from true north to the line connecting the airplane's position to the sub-point of the body, is computed by H. O. 218 or any other solution of the astronomical triangle. Magnetic azimuth is obtained when local variation is applied to true azimuth. Magnetic azimuth minus relative bearing gives the magnetic heading.

One method of finding the relative bearing is by use of the shadow pin. The shadow pin consists of an azimuth ring printed on paper and fastened to a wood or metal platform. In the exact center of the azimuth ring is a thin metal rod which projects vertically about three inches above the surface of the ring. As the name implies, the shadow pin is activated by the light of the sun which shows the shadow of the pin on the azimuth ring, allowing the relative bearing of the sun to be read. To do this, the pin must be very carefully placed. It is mounted in the turret with the 0°-180° line parallel to the longitudinal axis, with 180° to the front of the ship. Thus, if the sun is directly behind the airplane, the shadow falls on 180°, the relative bearing of the sun. In an AT-7, it is necessary to rotate the turret in order to get a shadow on some headings. When this is done, it is necessary to add or subtract 180° to the Shadow Pin reading in order to get the relative bearing.