

AIRCRAFT SEXTANTS

Know your sextant. The success of a vital mission, the lives of your fellow crew members, and the safety of your airplane are all dependent upon the accuracy of your calculations. They, in turn, depend upon the accuracy of your instruments and the skill with which you use them.

Tips

Always remove batteries from the sextant container as soon as your mission is completed. Corroding batteries ruin the rheostat and vernier-light battery case.

Keep the index mirror clean and free from greasy fingerprints. If the mirror does get dirty, clean it with lens paper or a well-washed handkerchief.

Severe changes of temperature may cause the index mirror to crack or break. Don't leave the instrument near a heating tube and then use it in a cold turret.

When you open the sextant case after a quick drop in temperature, moisture condenses on the sextant mirrors. To combat this, open the sextant case before you climb to a high altitude.

Batteries do not work well in extreme cold, so keep spares in a warm place, such as the pocket of your jacket, and replace them as often as necessary.

Always carry spare parts such as bulbs, batteries, and pencil leads in your sextant case.

Use a collimator tube, a precomputed curve, or a natural sea horizon to determine the amount of index error in your sextant. **Do not attempt to remove the error.** Note it and correct all subsequent observations by this amount. For any adjustments to your sextant consult an instrument specialist.

If your sextant requires the use of recording discs, be sure to keep them away from the heating tube of your airplane. If the case becomes hot, the wax on the discs melts and the whole supply sticks together.

If your sextant has a vapor bubble, be sure to release the bubble from the chamber during ascents, descents, and when you put the sextant away.

A-12 SEXTANT

Operation

There are two methods of using the sextant:

1. When you observe the sun, use the eyepiece and sunshades. You then are observing it indirectly, because the index glass reflects it to your eye.
2. When you observe the stars, use the direct method of sighting. This simplifies star finding and lessens the chance of observing the wrong star.

Median (Average) Sights

Take a series of shots, pressing the marking lever each time the body appears in proper position relative to the bubble. Take these shots only a few seconds apart.

It is good practice to observe a body for a period of one or two minutes in order to obtain the average time of the observation more readily.

Obtain the median reading in this manner:

1. If your shots are evenly spaced, use the middle mark on the rim of the drum. Rotate the drum until this mark is under the marking pencil. Then read the scale.
2. If your shots are not evenly spaced, rotate the drum until the visual average seems to be under the marking pencil. Your ability to estimate the correct median improves with practice.

Bubble

This sextant has a fixed bubble. The bubble assembly includes a bubble housing, two lenses with seals and locking rings, a filler hole, and xylene bubble fluid.

Optics

The index mirror is clear glass and optically flat. A clamp secures it on the same shaft that carries the sextant arm. With proper adjustment there is no lost motion between the arm and this mirror.

The lens tube assembly transmits the image of the bubble downward vertically from the bubble assembly and then up at an angle to the index mirror and your view.

The real field of the sextant is approximately 12°. See T.O. 05-35-15.

A-7 SEXTANT

Hold the instrument in both hands. Your right hand operates the micrometer drum while your left, besides furnishing additional support, operates the shade glass holder and the astigmatizer knob. When you use the artificial horizon, move the horizon shutter knob to its extreme position in the direction opposite that of the arrow. This keeps any direct horizontal light from entering the telescope.

Operation

1. Before taking a reading with this sextant, be sure to set the ratchet of the averaging device at 0 and adjust the pencil properly to give fine legible lines.

2. Sight through the instrument and bring the image of the celestial body into horizontal coincidence with the bubble.

3. To record the observation, press the trigger by moving your right thumb backwards without taking that hand off the sextant.

4. Repeat this procedure, without re-setting the ratchet, until you have recorded the desired number of observations.

5. Note the number in the ratchet and select the middle reading.

6. Having determined the middle reading, locate its pencil mark on the micrometer drum cover.

7. Align the pencil mark of the average reading with the end of the pencil.

8. Note the reading on the worm scale dial and micrometer drum scale. This quantity is the average angular altitude determined by the observations. The time of the observation is the median time between the start and finish of your observation.

Bubble

The bubble assembly which forms the artificial horizon consists of a field lens, bubble chamber, bottom glass, and diaphragm chamber with cap. A vapor bubble forms in the bubble chamber which, together with the diaphragm chamber, is filled with xylene. The bubble is formed and controlled in size by the deflection of a flexible diaphragm, which forms a wall of the chamber on the side of the bubble assembly. Control the deflection by turning the nut on the diaphragm cover. Radioactive luminous material, painted on a metal ring surrounding the bubble, amply illuminates it.

Before you put the sextant away in its carrying case, return the bubble control knob to neutral, loose on the shaft.

Optics

The instrument optics is so designed that the matching of the bubble's image with that of the body does not have to take place in the middle of the field. It is best to use the astigmatizer for accurate work because the way it flattens the image makes it easier for you to estimate the center of the bubble.

The real field of the sextant is approximately 12°.

See T.O. 05-35-4 for additional instructions on operation and care of this sextant.

A-8A SEXTANT

Operation

You can use this sextant for direct or indirect sighting.

1. Before you take any readings you must set the averaging device in the zero position. Do this by turning the vernier disc as far clockwise as possible. Then use the sextant in the usual manner.

2. As soon as you have taken a shot, place your right index finger in the concave portion of the handle and push it as far counter-clockwise as possible. Then return the handle to its original position. This operation moves the vernier disc counter-clockwise an amount equal to one-eighth of the total recording.

3. Repeat this procedure until you have taken a total of eight shots.

4. Then read the counter disc and vernier disc to obtain the average of these eight settings in degrees and minutes.

The average time is the time of the average altitude reading.

If the 0 line of the vernier disc points between two lines of the counter disc, read the lower of the two as the number of degrees. Add to this the reading of the vernier disc, expressed in minutes of arc.

In reading the vernier, follow the vernier disc counter-clockwise until a line of the counter disc appears to be a continuation of a degree line. The number of divisions in the vernier disc from 0 to the point where the lines coincide is the number of minutes you add to the scale reading.

A pencil averaging device is now available. To have your sextant modified, send it to any one of the following service commands:

Fairfield Air Service Command,
Oklahoma City Air Service Command, or
Sacramento Air Service Command.

Bubble

Use the dark field illumination of the bubble at night. This makes the bubble appear as a bright ring in a dark background. You can regulate the brightness of the bubble with the rheostat.

You can see directly through the center of the bubble to sight a heavenly body.

Optics

The focal length of the eye lens is equal to that of the objective lens.

The real field of the sextant is 9°.

See T.O. AN 05-35-7.

A-10 SEXTANT

Operation

Hold the sextant by its frame in the palm and fingers of your right hand. The control knob, which elevates the field prism, is down. Use your left hand to operate the control knob or to adjust the size of the bubble.

To register a line on the recording disc, move the plunger of the marker with your right forefinger.

The middle value of several readings in a series is the average of your observation. To obtain this reading, align the middle line of any group of readings with the index. Then read the counter to obtain this value in degrees and minutes.

If your observations are equally spaced, take a direct average. If they are not equally spaced, devise your own method of averaging them.

Bubble

Only the bubble itself is illuminated. This makes it easier for you to observe dim stars.

If the bubble disappears you can easily re-form it in this way:

1. Turn the sextant until the bubble-size knob faces downward.
2. Turn the bubble-size knob to its maximum INCREASE position, as indicated on the engraved diaphragm housing. Be careful not to force the knob past the limits of this position.
3. If the bubble is not visible, it may be formed in the diaphragm. Turn the knob to near its minimum position.
4. Hold the sextant firmly and snap your arm forward quickly, in order to release the bubble from the diaphragm housing.

5. An alternate method is to hold the sextant with the bubble chamber away from you and whip the sextant downward sharply.

Turn the bubble to maximum size when you put the sextant back in its case.

Optics

The auxiliary telescope and the eyeguard at the glass chamber housing are interchangeable. When you use the telescope you get a two-power magnification and your field is reduced approximately one-half.

The real field is approximately 14°.

The scales are illuminated. Replacement lights are provided, but in an emergency you can use the lamps out of the B-3 driftmeter, radio compass, or some other aircraft instrument.

See T.O. AN 05-35-12.

A-10A SEXTANT

This sextant is a modification of the A-10 sextant and includes the following new features:

1. An automatic marking device operated by a solenoid timing mechanism, which makes a mark on a plastic disc. You can operate the marker manually if the timing mechanism fails.
2. An air-reservoir bubble chamber which permits the bubble to form more easily and produces a bubble which is less affected by temperature changes than the previous vapor-type bubbles.
3. An improved lighting system for the marking disc and counters.
4. A 3-cell battery case which operates the electric timing mechanism and the lighting system.
5. The rheostat which controls bubble illumination is on the sextant instead of on the battery case.

Operation

You must use the battery case to operate this sextant, both day and night. The batteries provide power for a small electric clock in the housing on the left side of the sextant. Approximately once every second, so long as you press the trigger above the marking disc, this clock energizes a circuit which actuates the solenoid marker on the right side of the sextant.

Shake the sextant lightly to make sure that the clock has started; it does not always start when the battery case is connected. As soon as you complete your observations, disconnect the batteries to preserve them.