

## Instructions for assembly

The periscope is very easy to assemble. Just follow steps 1 to 9 and you cannot go wrong. It consists of only 4 parts, 2 die-cut cardboard parts and 2 high-quality steel reflecting mirrors. The polished surfaces of the mirrors are protected by a foil. Wait until the mirror is located in its final position before removing the protective foil. For assembly purposes, you will need a suitable sharp knife to accurately remove the parts out of the cardboard, and also a good all-purpose glue. A useful hint for quick gluing: An all-purpose solvent-containing glue gets the best results. Apply the glue on one side. Press the parts together so that the glue spreads over both surfaces. Then, separate the parts again and blow briefly onto the glue and then join the parts together again. Make sure that the fitting is accurate. It holds immediately!

### The upper part

(with the indicating instrument "pressure"):

- 1 Fold back (= away from you) all grooved lines.
- 2 Glue flap 1 behind the opposite side to form a rectangular tub. It is recommended to press the tube until the glue has dried.
- 3 Take one of the mirrors and glue it with the side without a protective foil onto the matching white surface on the inside of the mirror shutter marked "Spiegel bündig einkleben". Wait until the glue is dry before removing the protective foil from the mirror.
- 4 Give flap 2 and the two flaps 3 a strong bend backwards. First, turn over flap 2 and then the two flaps 3 and place the mirror shutter on top. Then push the two holding flaps with the round ends through the slanted inserting slots upwards into the side parts of the rectangular tube.

**Now, the upper part of the periscope is completed.**

### The lower part

(with the heading "Dieses Periskop gehört" = This periscope belongs to...)

- 5 Proceed exactly as in the case of the first two steps for the upper part. Before gluing the part together, check and see if the lower part fits accurately into the upper part without warping. If necessary, the seating of the side sticking flap can be moved in by a half of a millimetre and the cross-section of the lower part is reduced slightly in this way.
- 6 Glue the other mirror with the side without a protective foil onto the matching white surface on the inside of the mirror shutter.  
*ATTENTION:* Do not apply any glue around the two punched inserting slots within a periphery of about 2 cm. This is necessary to ensure so that the two holding flaps can later be pushed in from the outside through the inserting slots between mirror and cardboard. Wait until the glue is dry before removing the protective foil from the mirror.
- 7 Fold flap 2 with a strong bend backwards, also the two flaps 3. Place the mirror shutter onto the folded-over flap 2 and, at the same time, insert the two flaps 3 into the interior of the rectangular tube.
- 8 Push the two holding flaps with their round ends through the inserting slots. To make this easier, you can slightly expand the area between the cardboard and the mirror with the use of a blunt knife.

**Now also the lower part of the periscope is completed.**

**You now have the choice:** You can either glue the mirrors, the flaps 2 and 3 and the inserting flaps of the lower and upper parts together and then have a particularly stable periscope. Or you leave it those flaps unglued and you can put your periscope flat after use. It fits conveniently between the pages of a larger school-book.

## The Periscope

By means of a multiple mirror arrangement, a periscope enables you to obtain a view of the surrounding area without being seen yourself.

The word periscope comes from the Greek and means "a viewing device for the surrounding area", just as in the case of a telescope which means "a viewing device for remote distance" and a microscope which means "a viewing device for small objects". The syllable -scope refers to the viewing action and peri- to the nearby surroundings, as also for example in the case of the word "periphery".

Periscopes are an integral part of the standard equipment of submarines but they are also used in other military equipment as well. They are often combined with magnifying lenses for use in scissors telescopes.

They are used also in civil applications such as in the observation of wildlife, but their use here is rather limited. In former times when sports fields were surrounded with board fences, juvenile sports enthusiasts were often seen with self-made periscopes looking over the fence at the sporting event thus saving the money for the admission tickets.

Polished metal mirrors made from copper, bronze or silver are mentioned in the Old Testament and were items of luxury for the ancient Egyptians, Greeks and Romans. The first glass mirrors were manufactured about 700 years ago in Nuremberg and Venice. The history of mirrors as inexpensive everyday items is not much older than a hundred years.

The advantage of ordinary glass mirrors lies in the fact that the sensitive mirror layer made of silver or aluminium lies well protected behind the glass pane. For optical purposes, however, mirrors of this type are not suitable because the non-reflecting surface of the glass produces its own weaker mirror image that superimposes with the other one to form a double image.

This is why for more sophisticated optical purposes, only so-called surface mirrors are used. Metal mirrors have the advantage that they are more robust than glass which is mirror-coated on the surface. The AstroMediaU high-quality steel reflecting mirrors are provided by a leading German manufacturer and are produced in particular for highly demanding industrial applications.

## How to use your periscope

Put the lower part into the upper part in such a way that the centimetre number appear in the window "Altitude". If you now look into the opening onto the mirror, your vision is diverted upwards towards the second mirror where it is diverted again into the original direction. Your actual eye level has grown by the distance between the two mirrors.

Now you can see the world with the eyes of a person who is about half a metre taller than you are. With great ease you can look over fences and other obstacles or look around on high furniture and book shelves. You can adjust the additional eye level by moving the tubes into each other to a greater or lesser degree. The exact reading in centimetres is shown in the "Altitude" window.

You can also give the lower part a half turn and then put it again into the upper part. This gives you completely new and exciting perspectives. Using it as a rear mirror, you can look behind you or look under a table or under a car, or even look over your own head at the world behind you. But that will look somewhat different to what you normally see.

Try it out for yourself !