Scalar's Scope-On-A-Rope How-To Book

Margaret C. Henk

See: LSU-E-00-002 for activity folios
See: LSU-E-00-002

For: SeaScope Aquatic Activity Folios
(LSU Scope-On-A-Rope Series 1)

1. Looking for Ol'Crusty (crawfish)
2. Trailing the Snail
3. Secrets of Sand
4. Mosquitoes; their place on the planet

WWW.SCALARSCOPES.COM
for info on obtaining scope.
Scalar's
Scope-On-A-Rope
How-To Book

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Additional Help For Using Your SOAR

The following "set-ups" described here are also on the website www.scopeonarope.lsu.edu. Particular kinds of samples can usually be viewed best by using one or more of these set-ups, and Louisiana Sea Grant has published a number of activity folios that specifically refer to them.

If you discover a great sample or new set-up, you are invited to contact Cindy Henk at henkmc@lsu.edu or the website listed above to publish your discovery.

Sea Grant
LOUISIANA

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The Scalar Scope-On-A-Rope (SOAR) has been developed specifically for use by teachers and students. It allows any classroom with access to a regular television to SOAR through exciting hands-on activities that would normally require the use of several kinds of light microscopes and video cameras.

After one or two minutes of easy set-up, the SOAR provides an instant, in-focus magnified TV image of almost any object. By using the three interchangeable lenses included in the basic set, the teacher can present exciting demonstrations of samples such as butterfly antennae, crystal structures from the earth or the chemistry lab, protozoans swimming in their microenvironment, and even fingerprints with tiny active sweat glands.

Prepared microscope slides are easy to view. The SOAR can also be used like a regular video camera by using the basic "1X" lens to produce nonmagnified images on the TV screen.

All images produced on the TV screen may be recorded with a VCR, they may be instantly printed to photo-like quality with a video printer, or they may be digitized for computer display with regular software.

**BASIC SOAR RULES**

- **NEVER IMMERSE** the lens tip in a liquid.
- **NEVER TOUCH** anyone's eye or mouth with the lens tip.
- **TAKE PROPER PRECAUTIONS** to avoid spread of infection.
Basic Connections

With any lens in place on the handset (1), attach the cables to the cradle (2) and hand unit as illustrated. The camera cable (3) connects cradle and handset. Plug the other end of the yellow-tipped video cable (4) into the video input port located on the front or back of your TV. Plug in the power cord (5), then turn on the TV and the cradle switch. Make sure that the TV is set to display the video input line. Newer TVs will automatically switch to this mode when a cable is plugged into the port, but earlier sets require the appropriate channel setting. (Do you want to videotape the images? Plug the cable into the VCR video input port instead of the TV port, then select the VCR and TV's input lines that will present the SOAR image.)

To remove a lens, rotate it counterclockwise until the little index marks on lens and handset body are lined up. The lens is then freed and another one may be set in place. To secure the new lens in position, align the index marks and turn it clockwise. IMPORTANT! Make sure it clicks firmly into place.

GREAT SOAR FEATURES

Teachers like SOAR's usefulness!
• Ease of demonstrations
• Entire class can see the object at once
• Compact size and durability
• Hands-on opportunities
• Sophistication, with freeze-frame and lighting options
• Cross-curricular applications
• Value for special education needs

Students like SOAR, too!
• It's exciting!
• It is easy to operate
• The TV image is easy to see and share
• It has interesting features to compare
• It is easy to understand the sample because it is "live" not "prepared"
The easiest setup for effective hands-on discovery with SOAR is a **TOUCH AND VIEW** configuration. Lighting is provided by the handset itself, and whatever is touching the tip of the lens is in focus on the TV.

Use this setup as you would use a magnifying glass or a dissecting microscope to examine any object that can be touched.

**HINTS for TOUCH & VIEW SUCCESS**

Throughout this booklet, you will find hints for easy ways to view samples using Scope-On-A-Rope.

**WANT TO KEEP SPARE LENSES ORGANIZED WHILE VIEWING SPECIMENS?** Store the lenses in the cradle. Leave the 30X lens attached to the handset and place the small tip of the 1X and 200X lenses in the circular depressions (the 1X lens in the middle). Use the clear cover as a handy "no roll" container for "stand-by" lenses.

**DO YOU WANT TO VIEW PREPARED SLIDES?** Turn the slide upside down on a piece of smooth white paper and focus through the thick glass with the fine-focus collar. Most slides are about the same thickness, so if you are examining a lot of them at the same time, you will probably not have to change the focus after the first one.

**DO YOU WANT TO LOOK AT LIVING AQUATIC SAMPLES LIKE PROTOZOA OR ALGAE?** See SET-UP 7 (page 12).

**DO YOU WANT TO LOOK AT TINY CRYSTALS OR SAND GRAINS?** Invert a clear plastic petri dish LID, and add the sample. Place the DISH on top, sandwiching the small particles. Use colored construction paper (black, white, blue, etc) to change the background color. You may want to add water to the lid before putting the dish on top. See crystals dissolve or form over a longer period of time. If you don't want crystals to dissolve, use cooking oil instead of water.

**DO YOU WANT TO VIEW TINY FLAT OBJECTS LIKE POLLEN OR INSECT PARTS?** See Hints for Success with SET-UP 1 (page 4).
SET-UP 1: TOUCH & VIEW with 30X LENST

SET-UP 1 is recommended for an introductory SOAR demonstration. Attach the 30X lens to the handset. Make sure that the power is on for the SOAR and the TV. Hold the handset and touch the white conical lens tip to any object you wish to view. You will see on the TV screen an image of the object you are touching.

POLARIZING THE LIGHT Press the ON button on the handset. Toggling this button switches the light between polarized and nonpolarized illumination. One position may be better for your object.

IMAGE CAPTURE Press the REC button when an image is in view. Play it back by pressing the PLAY button. Two images can be stored at one time. Compare them by pressing PLAY three times. Press ON when you wish to return to regular imaging.

ERASE CAPTURED IMAGES Press the ERASE button on the bottom of the handset. Then press ON again.

HINTS for TOUCH & VIEW SUCCESS

ARE YOU LOOKING AT A VERY SMALL OBJECT? Try attaching it to a piece of paper of contrasting color with glue or a piece of double-stick tape, then lay it on a table for viewing. You can also attach it to clear glass or plastic and compare its appearance by trying different colors of paper underneath.

IS THE OBJECT BUMPY OR DELICATE? Try SET-UP 4 (page 8).

IS THE OBJECT FLAT WITH TWO INTERESTING SIDES? Butterfly wings and the like can be mounted between two glass slides taped together on the ends for viewing from either side.

WANT TO MEASURE AN OBJECT? It's easy with a TV ruler. Instructions on how to make this tool for your classroom can be found on page 16.
SET-UP 2 is recommended when a higher magnification is required and the object is rather flat. Any lens that provides high magnification is automatically less able to focus "tall and short" objects simultaneously. Therefore, it is advisable to start using the 200X with flat surfaces such as fabric, paper, or a prepared slide. You can also try the butterfly wing under glass (see SET-UP 1, page 4).

Attach the 200X lens to the handset. Touch the clear dome (the light collector) to a flat object. The 200X lens is provided with a fine-focus adjustment in order to sharply focus the interesting part of the object. Rotate the white, fluted ring around the lens to achieve proper focus while you maintain contact with the object. If focus is not cleared up by turning in one direction, switch directions. Focusing requires some dexterity, so use this set-up yourself as a demonstration or supervise middle and high school students initially as they learn to manipulate it.

IMPORTANT! For TOUCH AND VIEW, the white focus ring should be unscrewed 1-2 mm for good focus. When focusing through glass or plastic, the ring will be screwed in closer.

**HINTS for TOUCH & VIEW SUCCESS**

**IMAGE CAPTURE AND ERASE.** These functions are the same as for the 30X in SET-UP 1. The light cannot be polarized with the 200X.

**LAB PRACTICALS?** It is easy to give lab practicals by using the SOAR with SET-UP 2 (or SET-UP 5, page 9) because you can point to the image on the TV and everyone can see at the same time. You can also videotape your lab practicals. (Great for make-up exams!)
If you have an extendable stand for your SOAR, its usefulness increases considerably. Attaching the handset to the stand frees the hands for manipulating the sample or for pointing out details on the TV screen. It also steadies the image as a camera tripod does and makes videotaping easier. It is easy to attach and remove, as well as being compact and efficient.

If your SOAR handset does not already have a "saddle" as illustrated, you will need to attach the one that comes with the stand kit. Once the saddle is attached, use the screw on the attachment bar to tighten the bandset into place on the extendable stand.

The nonskid attachment bar on the stand can be rotated so that the SOAR can face toward the legs or away from them without making the image upside-down on the TV.

**EXPANDING YOUR SOAR SET-UP**

**WANT TO TAKE SOAR ON A FIELD TRIP?**
SOAR can be taken to the field using a portable battery. For about $125, you can get a portable AC/DC battery pack (and connecting cables) that will power your SOAR and an AC/DC portable TV for one to two hours. A special connector cable is necessary. For details about this option, visit www.ScalarScopes.com.

*The portable SOAR fits nicely into a cooler for ease in transport*
SET-UP 3: STAND & VIEW with 1X LENS

Attach the 1X lens. Notice that this lens has no built-in lights and that no image is visible when it is touching an object. This lens is like a regular videocamera lens, and can be used for exactly that purpose when the SOAR is connected to the TV through a VCR.

Adjust the stand and SOAR so that the desired image is in view, then focus it by using the black knurled ring around the 1X lens. Press the ERASE button and the ON button, and decide which of these gives the best color (light temperature display is being toggled between two different settings).

The 1X becomes very useful as both a magnifying and a nonmagnifying aid for the classroom. Demonstrating procedures such as dissection techniques or threading a sewing machine, displaying texts or pictures available only in single copies from books, and videotaping in any of these modes can easily be done by using the 1X attached to the stand.

Images can be captured and erased but not polarized.

HINTS for STAND & VIEW SUCCESS

DO YOU WANT TO RECORD SOUND WITH YOUR VIDEOTAPE IMAGES? Use a microphone/sound mixer plugged into the audio input port of the VCR while you record.

DO YOU WANT TO WATCH AQUATIC CREATURES? Place them in a square-sided miniaquarium (the narrower, the better). Use a shaded light above or beside the aquarium, and position the SOAR with a 1X lens on its stand near the aquarium. Place the SOAR close to the aquarium for high magnification or farther away for lower magnification. Focus the SOAR by rotating the black ring. See SET-UP 4 (page 8).
SET-UP 4:  
STAND & VIEW with 30X LENS

When a sample requires protection from damage (e.g., an historical document, or a framed painting) or the student requires protection (e.g., from a bee colony) it is good to separate sample from student by using glass. The white tip of the two-part 30X lens may be removed so that the distance taken up by thick glass can be accommodated. This setup is also useful for large inert insects or other uneven surfaces.

Attach the 30X lens to the handset held in place on the stand. Unscrew the white tip of the two-part 30X lens cone AND KEEP IT IN A SAFE PLACE. YOU WILL NEED TO REPLACE IT FOR SET-UP 1, the most common SOAR setup. Adjust the stand height to the proper distance from the surface of the object. For best results, try to keep the handset more or less parallel to the surface plane of the object. You can hand-tighten screws on the stand if it seems to droop. Objects can be conveniently moved around under a horizontal SOAR by placing them on contrasting paper and moving the paper.

Images can be captured, erased, and polarized.

HINTS for STAND & VIEW SUCCESS

DOES THE GLASS SURFACE REFLECT TOO MUCH LIGHT?  
Try toggling the ON button to benefit from polarized light. Often adjusting the angle can also reduce reflection.

IS THE LIGHT TOO BRIGHT OR TOO DIM?  Try shielding the light by taping a piece of white paper in front of the light or change the position of the light.
SET-UP 5:
STAND & VIEW with 200X LENS

Viewing multiple prepared slides or similar objects can be more efficient with the 200x mounted on the stand. Because the teacher's hands are not required to hold the object and lens in place, there is freedom to move around and point out details on the TV.

Attach the 200X lens to the SOAR mounted on an extendable stand. Place the slide or other thin object on a smooth white (or sometimes black is better) background paper on the table top. Adjust the handset and stand until the SOAR is horizontal and not quite contacting the slide surface. Move the slide by moving the paper. The directions will look right on the TV if the handset body is pointing "north" with the ON button on your left as you look down at it. You may find that placing the slide and paper on a small "lab jack" makes the height and focus easy to adjust.

HINTS for STAND & VIEW SUCCESS

DO YOU HAVE MULTIPLE CLASSES? You can videotape a series of slides to show.

DO YOU WANT TO VIEW TINY FLAT OBJECTS? See Hints for Success with SET-UP 1 (page 4).

IS THE STAND GETTING TOO LOOSE OR TOO TIGHT? Use coins in the sets of two opposing white "screws" and turn them in opposite directions to tighten. Reverse the directions if you need to loosen them.
The cradle for the SOAR can serve as a convenient and sturdy base for using it in the inverted position, the best configuration for viewing aquatic samples of all kinds. Your SOAR cradle should have Velcro® hooks attached to the sides as shown to hold the handset in place with the loop strap to tie it down.

**HINTS for INVERT & VIEW SUCCESS**

**DO YOU WANT TO WATCH LIVING ECOSYSTEMS?**
Use invert and view for unattended continuous viewing of exciting aquatic microorganisms. Just collect an aquatic microcosm sample and let the organisms go about their daily activities — on TV.

**MICROCOSM SET-UPS...**
...make viewing aquatic specimens and ecosystems easy.

- **Culture tube**: Usually shipped by supply houses and contain specific organism cultures.
- **Deep-well slide**: Available from supply houses under different names. Small aquatic ecosystems can be set up and left to evolve.
- **30mm or 60 mm petri dishes**: Aquatic specimens of interest are placed in the lid of the petri dish. The bottom of the petri dish is inverted and placed on top.
SET-UP 6:  
INVERT & VIEW with 1X LENS

This set-up is used for medium-sized aquatic samples, such as small starfish, insect larvae, fish hatchlings, snails, planaria, oligochaetes, and small aquatic plants. It can also be used with small insects contained in petri dishes or deep-well slides.

With the attached 1X lens facing upward, place the handset into the cradle and fasten the Velcro® strap snugly against it. Your aquatic sample may be contained within a 2" x 2" deep-well projection slide (see photo on page 13). Rest the projection slide on top of the black focus ring of the 1X lens.

To help adjust the light, shield your specimen with a 2" x 2" piece of smooth white paper placed on top of the projection slide. Bring your specimen into sharp focus by adjusting the focus ring.

You can also use a 30 mm petri dish to view specimens, but be careful. No water should ever touch the inside of the lens. The small petri dish will fit right into the black collar of the 1X objective. Cover the dish with a 1 ½" square of white or black paper (experiment!), and focus with the ring. Remember that you can change the color of the screen by pressing either the ON button or the ERASE button.

BE CAREFUL NOT TO SPILL WATER INTO THE LENS

HINTS for INVERT & VIEW SUCCESS

DO YOU WANT TO RECORD IMAGES OF LIVING SPECIMENS?  
By all means try to videotape living creatures. A moving image is much more meaningful than still views. See SET-UP 3 (page 7).
SET-UP 7:

INVERT & VIEW with 200X LENS

This set-up is used for discovering the amazing array of small creatures that can be found in many roadside ditches. Biological supply houses can ship organisms in culture tubes that can be directly viewed with the SOAR. (See Hints for Success for other microcosms ideas.) A Scalar 200X stage, a collar assembly, and an external light source are required for best results.

Invert the SOAR with attached 200X lens, place the black collar over the light collector dome of the lens, and fit the stage into place with the collar and flat foot of the handset. Use the Velcro® strap to tie the stage support in place. Aquatic samples in flat-tip culture tubes, deep-well slides, or 60 mm petri lid/dish "sandwiches" (See SET-UP 2) can be placed on the stage over the center of the lens. To form a useful "shade" tape a band of black cardboard about 2" wide about 2" from the free end of a color-balanced work lamp of the type shown. Turn the light on and position this black background directly over the inverted 200X lens. Focus the image by turning the black collar. Your sample should not move very much as you turn the collar. Even though the separate work lamp is on, you should make sure that the SOAR light is on as well. Adjusting the light angle can make a big difference in observing these sorts of specimens.

IMPORTANT! When focusing through the plastic containers the collar will have to be turned almost completely clockwise. Avoid detaching the whole lens when unscrewing the collar to adjust focus. (See “Basic Connections” page 2)
DOES YOUR SAMPLE LOOK TOO MURKY? To prepare an interesting assortment of small ditch creatures use tweezers to pick out a small cohesive strand, preferably green, then pipette clear water from your sample into the petri lid or deep-well slide. When you put on the slide top or the petri dish, try to avoid bubbles.

ARE THINGS CHANGING IN APPEARANCE AFTER THEY HAVE BEEN EXAMINED IN THE LIGHT FOR A WHILE? Great! You are watching natural processes at work. Some organisms are attracted, others repelled by light, life cycles are triggered, predation occurs, algae produce oxygen. Little ecosystems can be studied with SOAR for a week or more, and water can be added to petri sandwiches without greatly disturbing the creatures within.

EXPANDING YOUR SOAR SET-UP

DO YOU WANT TO DISPLAY THE SOAR IMAGE ON MORE THAN ONE TV? Purchase a "rat tail" RCA cable splitter (one plug with two ports) and a second RCA video cable (you can get a long one if the second TV is far away from the first) from an electronics supply store. Connect the rat-tail plug to the SOAR cradle, and plug the regular SOAR video cable and the new one into the two ports. The other ends of the cables connect to the TV’s video-in ports as usual. You can also plug into a video projector instead of a TV if you wish.

DO YOU WANT TO MAKE PICTURES OF YOUR SOAR IMAGES? You can use a printer such as the Scalar Digital File Printer SP-X1 to produce good quality postcard-sized prints. Use the cable splitter (above) and connect the printer in place of the second TV. Follow instructions for making prints.
A. No picture on TV, red light not shining on SOAR cradle
   Check that the power cord is plugged in and well connected to the SOAR, and that the cradle switch is turned on.

B. No picture on TV, red light is shining on SOAR cradle
   1. Check that the video cable is pressed on handset.
   2. Check that "ON" button is pressed on handset.
   3. Check that correct channel or line is selected on TV and/or VCR.

   Unfortunately there is no industry standard. If you do not have access to the instructions for your set, try the following:
   On your TV, try the channel below #1, or if you know which channel is used for video games, select that one. A VCR may automatically select the correct line if you insert a videotape. It may also have a switch on the back or on the menu allowing you to choose between lines "1 & 2" or "A & B" or to choose "A/V in." Try this switch. When you see an "A" or "B" in the lower right corner of the TV screen, you know that your SOAR is now being displayed on the TV. When you have determined the proper set-up steps, write them down on a label and attach it to the TV/VCR. If you cannot establish communication between the SOAR and your TV, contact the TV or VCR manufacturer (try the Web) or check the troubleshooting address at www.scopeonarope.lsu.edu.

C. 1X image is strange color
   1. Press the ERASE button or the ON button and choose the better color.
   2. Adjust ambient lighting by increasing or decreasing the light level in the room or area.

D. 1X or TOUCH AND VIEW image object is too dark or light against background
   Change the darkness of the background, perhaps by using black, white, or gray paper.

E. 200X INVERT AND VIEW image is too dark or light against background
   Using a work lamp with a shade, adjust the position of the lamp above the SOAR, rotating or offsetting the shade slightly so that the light angle on the specimen varies. Some details appear better with one light position and others with a different one.
F. 1X image appears fuzzy
   1. Focus the image by turning the knurled black ring at the periphery of the lens.
   2. See G-3 below.

G. 30X or 200X image appears fuzzy or has the same dark spots no matter what sample is viewed
   1. For TOUCH AND VIEW make sure that contact tip is attached properly.
   2. For 30X, allow for focus of recessed areas by removing contact tip (DON'T LOSE IT), and supporting the handset at an appropriate distance from specimen. For 200X, adjust white focus ring until image appears focused. (Ring will not be screwed tightly against its black or gray base.)
   3. Remove lens and check that no foreign object is in handset or on back of lens. You may use a compressed air duster to remove dust particles, but ALWAYS BE SURE TO HOLD THE DUSTER CAN UPRIGHT OR YOU WILL SQUIRT LIQUID SOLVENT INTO YOUR SOAR. Stubborn particles may be LIGHTLY brushed off the small green rectangle in the handset with a cotton swab. For a particularly bad contamination problem you may need professional assistance, or check the troubleshooting address at www.scopeonarope.lsu.edu

H. 30X lens comes apart
   If someone inadvertently unscrews this lens, collect the parts. You should have three main pieces: the contact/noncontact cone and tip, a doughnut-shaped piece, and a piece with an "axle."
   1. While everything is apart, remove any dust. See G-3 above.
   2. Find the small index mark on the perimeter of the doughnut-shaped insert. This is the light unit and contains the lights and polarizing filter.
   3. Look at the part with the black "axle" (the optical lens). One end has only two metal studs showing. Above the screw threads at the periphery is another TINY index mark.
   4. Hold the light unit so that all of the metal dots will be facing the metal studs in the lens unit.
   5. Rotate the pieces so that the index marks are lined up and gently jiggle the light unit into place. Part will extend above the edge of the lens unit.
   6. Screw the cone/tip section back into place against the screw threads of the lens unit, making sure all is firmly secured in place.

I. Problem doesn't appear above or remedies don't work
   Consult the troubleshooting address at www.scopeonarope.lsu.edu or consult your vendor.
Make a TV Ruler for the 30X Lens.

An easy way to measure objects with the SOAR 30X lens

1. Scope a metric ruler (units in millimeters) with the 30X lens.

2. Record the ruler’s image by pressing the RECORD button. Play the recorded image back by pressing the PLAY button.

3. Tape a transparency sheet to the TV screen, so that the millimeter divisions can be traced in a convenient orientation. (You can also position the edge of a regular sheet of paper against the marks.)

4. Use a marker to trace the millimeter divisions onto the transparency sheet (or on a margin of the sheet of paper).

5. On your transparency sheet, write the unit size (1 mm), the lens magnification, and the diagonal TV size (e.g., 13”, 19”, or 25”).

6. Scope an object and record it if you wish. Line up your new TV ruler on the image, and use it to measure your object.

HINT: You must always use this micro ruler with the 30X lens magnification, and also the appropriate TV size. Why?

Alternative Ruler

As an alternative ruler, you may use a nonconventional unit of measurement, the "A," for the 30X and 200X lenses. The width of the letter "A" that appears at lower right measures about 0.5 mm at 30X and about 75 μm at 200X. This is true for any size TV monitor; ask your students to explain. See www.biology.lsu.edu/soar/index.html.

To make a TV ruler for the 200X lens, see page 17.
Make a TV Ruler for the 200X Lens.

**An easy way to measure objects with the SOAR 200X lens**

A. If you are using the 200X lens, you will need a tiny ruler. A stage micrometer (used for regular microscopes) is perfect. You can focus the micrometer and follow Steps 1 - 6 on page 16. Units will be in **0.1mm** (or 100 µm) divisions.

   OR

B. If you don't have a suitable ruler of this type, you can multiply the distance between your 30X micro ruler's marks by 0.67 to get the measurement for **0.1mm** at 200X with the same TV size.

   OR

C. You can use a copy of the ready-made rulers on page 19. Choose the correct TV size.

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**Measuring with SOAR**

**Measuring area**

Making a 30X AREA GRID.
You can also measure area by counting square millimeters. Make a grid by scoping a millimeter ruler and then tracing the ruler divisions on the long edge of the transparency. Rotate the transparency 90º, and then mark the ruler divisions on the short edge as well. Lengthen the lines to make a grid, keeping the lines parallel to one another.

To use your 30X AREA GRID, tape it to the TV screen and count square millimeters of area taken up by the object of interest. Remember to record the three important pieces of information on your TV grid: unit size, lens magnification, and diagonal measurement of your screen.

Making a 200X AREA GRID.
If you want to measure area using the 200X lens, follow the instructions above for the 30X AREA GRID, but use the 200X lens. The squares will cover 0.01 square mm or 10,000 square µm.
WANT TO USE SOUND WITH SCOPE-ON-A-ROPE?
Purchase a sound mixer for your SOAR set-up. The sound mixer should include an amplified microphone.

**FOR A TV/VCR COMBINATION:**
1. Connect your SOAR as usual.
2. Connect the microphone to the mono-L plug on the sound mixer.
3. Connect an audio cable (identical to SOAR's video cable) to the sound mixer's output port and the TV/VCR's audio-in port.
4. To record sound and picture, turn on the microphone and sound mixer, then press the VCR RECORD button.

**FOR SEPARATE TV AND VCR:**
1. Connect the SOAR and mixer to the VCR with four identical cables.
   - VCR video-in \(\rightarrow\) connects to \(\rightarrow\) SOAR video-out (cradle)
   - VCR video-out \(\rightarrow\) connects to \(\rightarrow\) TV's video-in
   - VCR audio-in (left) \(\rightarrow\) connects to \(\rightarrow\) Sound mixer audio-out
   - VCR audio-out \(\rightarrow\) connects to \(\rightarrow\) TV's audio-in
2. Connect the microphone to the mono-L plug on the sound mixer.
3. Check your VCR to make sure the correct video-out "line" is selected. You should have a live SOAR picture on the TV and, when the microphone/sound mixer is turned on, sound.
4. To record sound and picture, turn on the SOAR and both the microphone and sound mixer, then press the VCR RECORD button.

**HINTS for HEAR & VIEW SUCCESS**

Sound can be recorded only while the SOAR image is being recorded, unless you want to make an additional tape with added sound. You will need two VCRs. Play the original SOAR video on VCR 1 with a cable from its video-out to VCR 2's video-in port. Plug the sound mixer into VCR 2's audio-in port, insert a blank tape into VCR 2, and record sound while the appropriate image is playing and being recorded on VCR 2.
200X TV Rulers for TV Screens

13" TV
0.1 mm (100 µm) units
0 0.1 mm 0.2 mm 0.3 mm 0.4 mm

19" TV
0.1 mm (100 µm) units
0 0.1 mm 0.2 mm 0.3 mm 0.4 mm

25" TV
0.1 mm (100 µm) units
0 0.1 mm 0.2 mm 0.3 mm 0.4 mm

27" TV
0.1 mm (100 µm) units
0 0.1 mm 0.2 mm 0.3 mm 0.4 mm