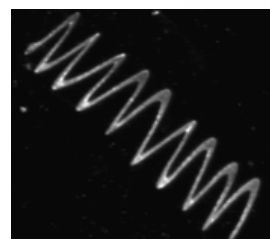
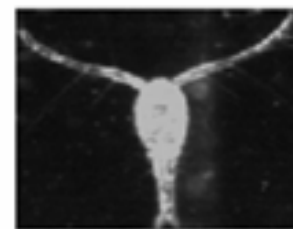
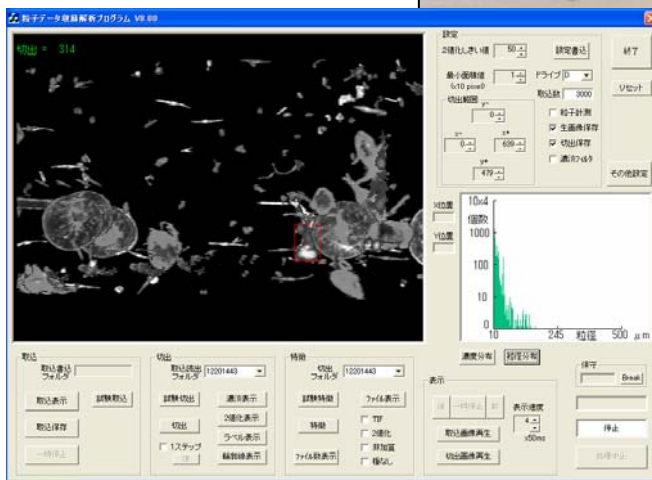
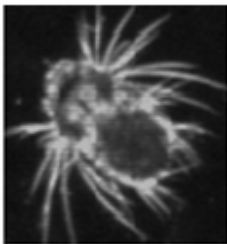
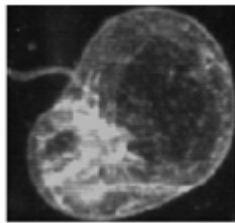


## Introducing an instrument that automatically gives you the size distribution of floating particles

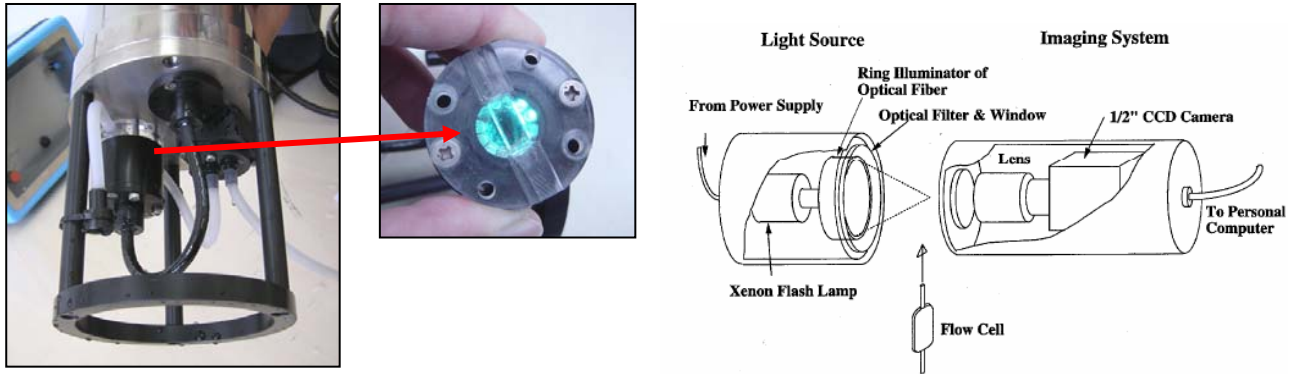
Alec Electronics has developed an instrument that automatically measures the size distribution of particles in water. The instrument was developed in joint collaboration with the National Institute of Advanced Industrial Science and Technology (AIST). It uses a microscopic camera/software system to measure the shape and particle distribution of particles more than 10 $\mu$ m in diameter.



## 1. Hardware

The instrument's operation is based on the studies made by Drs. Akiba Tasuro and Kadoi Takami of AIST (Design and Testing of an Underwater Microscope and Image Processing System for the Study of Zooplankton Distribution/IEEE JOURNAL OF OCEANIC ENGINEERING, VOL 25, No.1 January 2000).

a) A progressive 300,000 pixel CCD camera is mounted in a pressure case, the flash is shone through a ring-shaped optical fiber into the camera lens. Objects show up as two dimensional figures that are white against a black background with a field of vision of 2.28x3.00 mm. The monochrome images are analyzed and the size distribution is calculated in real time by a high speed processing unit.

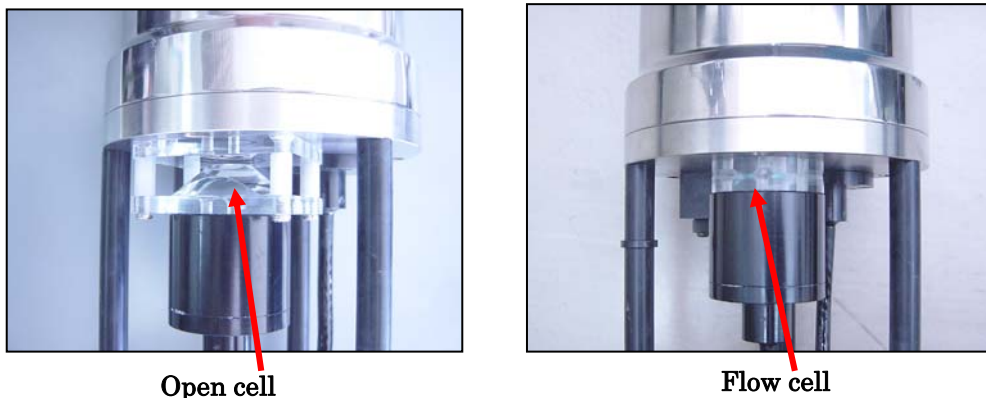


b) High speed continuous imaging

The camera can take continuous images corresponding to the user selected flash rate. This flash rate is changed by a dial on the control device. At the maximum flash rate of 20Hz, 6000 images can be taken in 5 minutes using a 40ml sample volume.

c) Flow Cell and Open Cell Configuration

The device is equipped as a standard with both flow cell (with a miniature pump) and open cell (cone shaped glass) sampling configurations. When accurate particle density is required, the flow cell configuration is recommended. The open cell configuration is best for general observations. The image quality is identical in either configuration.



d) High-speed image down load

Images can be downloaded to a desk top computer or through a PCMCIA card interface to a lap top

e) Small and light weight

The instrument is 436 mm long, has a flange diameter of 110 mm, weighs 3.5 kg in air and 1 kg in water. The depth rating is 100m. The pressure case is titanium and the water proof control unit is made of FRP.

## 2. Software features

### a) Image download

The images are stored at high speed in 9999 image blocks. The images can be stored in an internal hard disc or in an external hard disc. The size distribution is measured simultaneously during download, so you can verify the image data and monitor the results in real time.

### b) High-speed image analysis

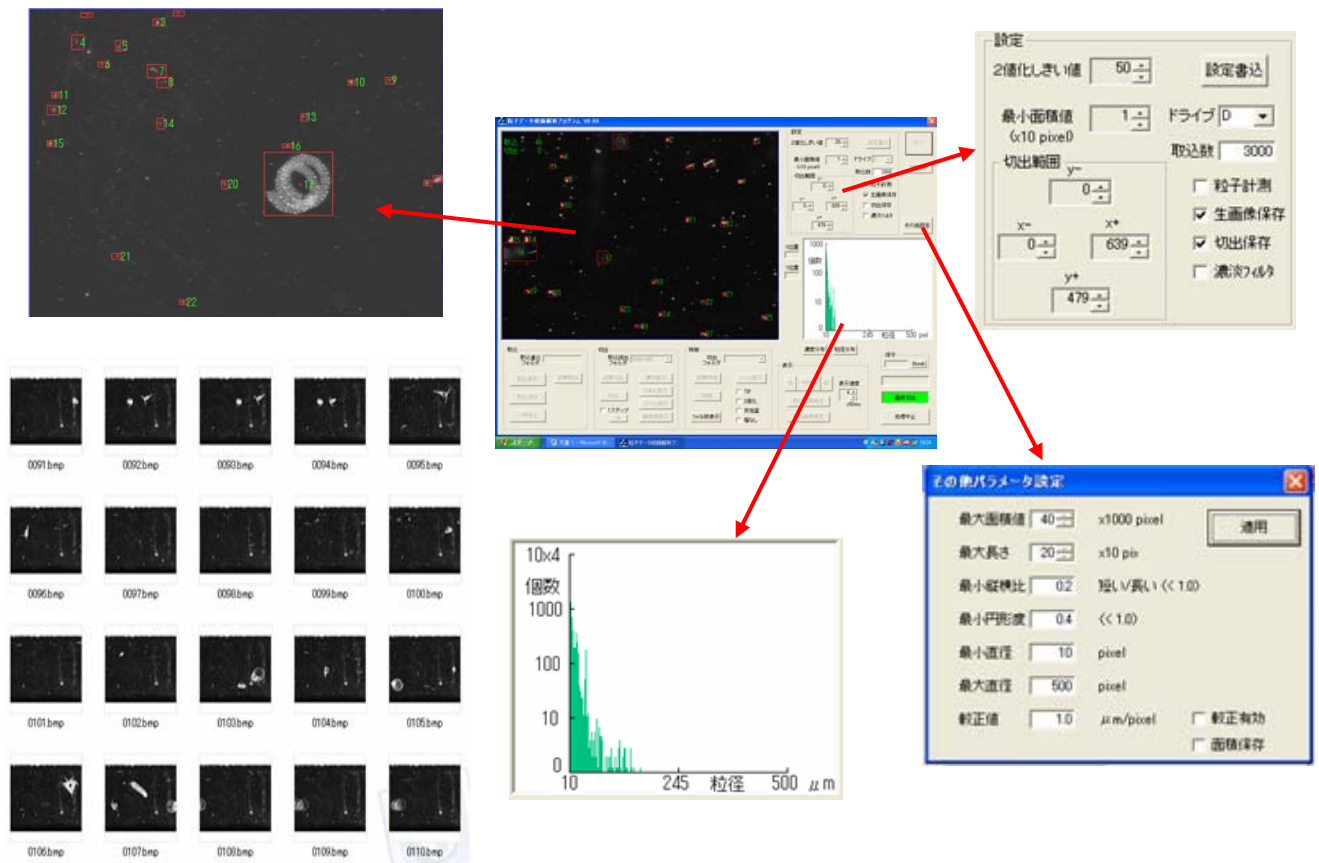
After you select the pixel size correction factor and the appropriate maximum/minimum size filter for your images, the software will automatically display a histogram for the images.

### c) Image correction

The program can correct shading and can display outlines, which allows you to measure particles correctly. You can also filter extremely long objects, narrow objects and/or entangled objects.

### d) Cut out function

The software allows you to select certain sized images to cut-out. These cut-out images can be labeled and stored in bitmap format.



### e) Software environment

The size distribution data are stored as text data. Standard size distribution data are displayed with the count value in the vertical axis and diameter in the horizontal axis. Diameter size distribution and various average processing calculations can be carried out easily with the data in the text format.

## Main Specification

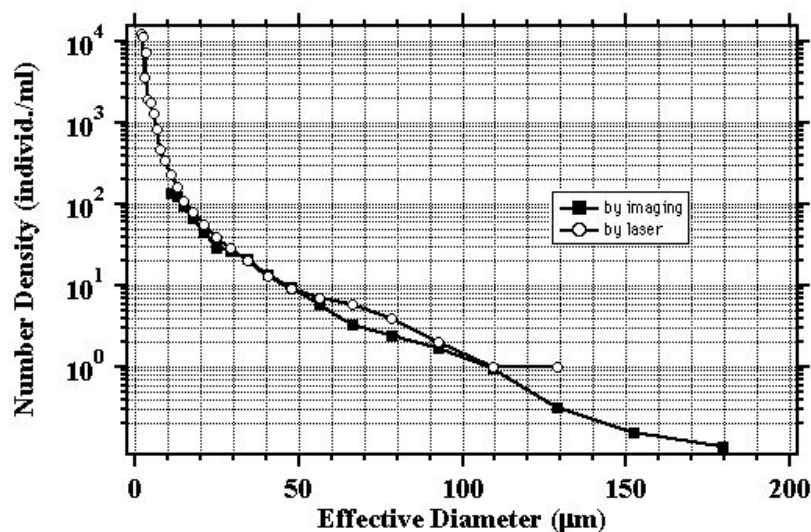
Instrument	Progressive scan 1/2 type CCD Model: XC-HR57 Maker : SONY Effective pixel : 659(H) x 494(V) Output pixel : 640(H) x 480(V)
Lens	Fixed magnification Maker: KEYENCE Model: VH-100 Optical magnification: 2.1X Measurement viewing range: 300(H) x 2.28(V) mm Depth of focus: 1 mm (1 pixel = 4.63 $\mu\text{m}$ )
EIA signal	Composite video signal
Power source	AC100V
Current consumption	9W
Flash lamp	Power source: LED Exposure time: 10-200 $\mu\text{s}$
Sensor	Diameter: 110 mm (flange), Length: 436 mm (excl. cable) Weight in air: 3.5 kg; in water: 1 kg (excl. cable) Material: Titanium

### 3. Verification in field test

The figure below [extracted from: Proceeding of Ocean Optics XVI,(2002) T.Akiba and T.Horiuchi. "PRESENT STATUS OF AIST'S TECHNOLOGIES FOR FLUORESCENT AND SCATTERED LIGHT IMAGING OF PHYTOPLANKTON IN FLOW"] shows the size distribution of suspended sediments measured in 6-m depth off Amagasaki city, west central Japan, by a SEQUOIA LISST-100 and an Alec Electronics underwater microscope. As the LISST-100 was measuring vertical distribution, the data show instantaneous values. Meanwhile the underwater microscope was measuring samples in the flow cell configuration. The data are from the mean value of a 19-mL sample volume. As seen in the figure, both instruments provided consistent data (White Circle – LISST, Black Square – Underwater Microscope).

### 4. Summary

Alec Electronics underwater microscope is a compact, easy to use, rugged instrument that provides accurate size distribution of particles above 10 $\mu\text{m}$  in diameter.



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