



# NAVAL RESEARCH LABORATORY

## ENVIRONMENTAL CELL

### ADVANTAGES

Provides accurate and cost-effective data

Enables testing of compression in aqueous or fluid systems with a Nano-Universal Loading Frame from Agilent Technologies and similar devices from other companies

Device can be used in geotechnical engineering, biomechanical research, food testing, and engineering of tissues, soft composites etc.

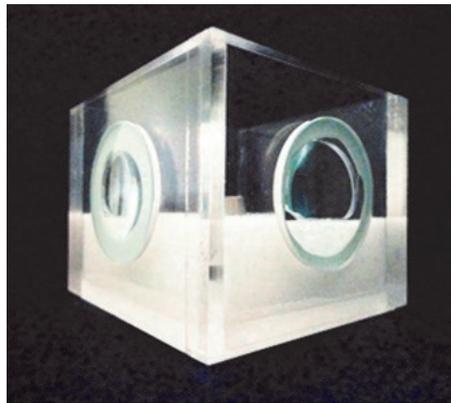
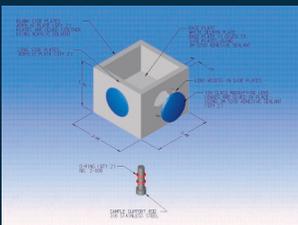
### APPLICATIONS

Geotechnical Engineering – Road maintenance, levees, berms, and contaminant caps.

Biomechanical testing

Food testing

Soft composite engineering



NRL has developed a tool to facilitate the quantification of compressive strength of soft materials, such as clays, biopolymer-clay mixtures, food items, tissues, cells and similar materials. The specific goal of this device is to facilitate compressive tests for biopolymers (i.e. natural or synthetic compounds that consist of large molecules made of many chemically bonded smaller identical molecules, e.g. starch and nylon, produced in living organisms) and sediments. Biopolymers are increasingly used to promote the strength of levees, berms/ridges, embankments, and contaminant caps. Consequently there is an ever growing need to quantify the geotechnical properties of biopolymer-clay test materials. Currently, tests in artificial channels or chutes of water (flumes) are used to evaluate sediment strength in underwater environments and instruments for measuring firmness. Cone penetrometers are used in field-scale evaluations; however, these tests require large amounts of time to measure large volumes of material.

The Environmental Cell enables new, accurate, and cost-effective data collection in greatly reduced times and with less sample material than previously possible. Consequently, more tests can be done on more materials for lower cost and within a much shorter time frame. Accurate, precise, and informative bench-scale tests can be readily conducted prior to larger scale evaluations more rapidly than in flume studies. -

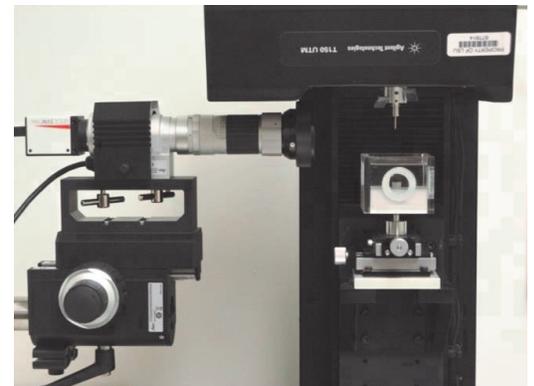
The Environmental Cell is designed for nano/micro mechanical testing of materials submerged in liquid. It can be used on particles from  $\sim 10$  to  $5000 \mu\text{m}$  to conduct tests that extend

beyond compression testing to include biomechanical studies of tissues, composites, and food items.

It can be used in testing the strength and weakness of sediment in lakes, canals, and other waterways to provide a better comprehension of the conditions of levees and embankments where heavy flooding is a common event. It can be used when it is impossible to know the exact strength or weakness of an underwater environment's deposits or residue. This helps to determine how deposits and residues compress, collide with other objects, and deposit on the seafloor, making it possible to determine areas that are diminishing in sediment build-up.

In other applications, the Environmental Cell can be used to determine how fast or slow a substance will dissolve in liquid (i.e., drink mixes, dyes, etc.) or to determine how well a food substance can withstand compression or pressure, such as how well tofu or gelatin will retain its structure.

In modeling experiments, data obtained using the Environmental Cell can be used to validate results obtained from models used to predict interactions between clay-aggregate particles during transport, or to determine compression or consolidation of particles subjected to modeled loads and stress rates.



### References

Related patent application: US Patent Publication No. 2009-0208372.

Licenses are available to companies with commercial interest.

### IDENTIFICATION NUMBER:

OCN16



Technology Transfer

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