

# SOFTWARE, CONT.

The Optical Array Shadow Imaging Software (OASIS) system is designed for rigorous post-processing analysis. It provides additional particle statistics beyond those generated by PADS. In addition, OASIS allows users to filter particles by various criteria, including particle area, particle shape, area fraction, and

inter-arrival time. Written in IGOR Pro, OASIS leverages IGOR's robust statistical analysis features for enhanced data analysis and graphing capability.

For additional information on PADS or OASIS, see the brochures for these products.

# CIP

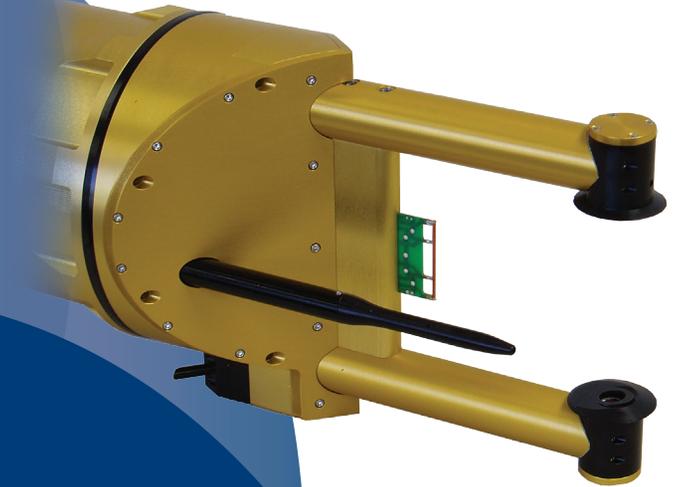
## CLOUD IMAGING PROBE

## HOW THE CIP WORKS

Shadow images of particles passing through a collimated laser beam are projected onto a linear array of 64 photodetectors. The presence of a particle is registered by a change in the light level on each diode. The registered changes in the photodetectors are stored at a rate consistent with probe velocity and the instrument's size resolution. Particle images are reconstructed from individual "slices," where a slice is the state of the 64-element linear array at a given moment in time. A slice must be stored at each time interval that the particle advances through the beam a distance equal to the resolution of the probe. Optional grayscale imaging gives three levels of shadow

recording on each photodetector, allowing more detailed information on the particles.

The CIP also contains a Hotwire LWC sensor. This sensor estimates liquid water content using a heated sensing coil. The system maintains the coil at a constant temperature, usually 125 °C, and measures the power necessary to maintain this temperature. More power is needed to maintain the temperature as droplets evaporate on the coil surface and cool the surface and surrounding air. Hence, this power reading can be used to estimate LWC. Both the LWC design and the optional PADS software contain features to ensure the LWC reading is not affected by conductive heat loss.



## INCLUDED ITEMS

- » Instrument
- » Shipping case
- » Operator manual
- » One-year warranty
- » Spinning disk for calibration check
- » One day of training at DMT's facility
- » Email and telephone technical support

## ACCESSORIES

## HOW TO ORDER

- » Particle Analysis and Display System (PADS) software
- » OASIS Software
- » Data Acquisition System

Contact DMT for pricing or more information:  
+1.303.440.5576,  
customer-contact@dropletmeasurement.com.



# OVERVIEW

The Cloud Imaging Probe (CIP) is a state-of-the-art probe that offers comprehensive data on larger cloud particles. The CIP provides the following measurements:

- » Precipitation size distributions from 25  $\mu\text{m}$  to 1550  $\mu\text{m}$ , or 15-930  $\mu\text{m}$  with optional 15- $\mu\text{m}$  resolution
- » Particle images for 25  $\mu\text{m}$  to 1550  $\mu\text{m}$  particles (15-930  $\mu\text{m}$  with 15- $\mu\text{m}$  resolution)
- » Liquid water content from 0.01 to 3  $\text{g}/\text{m}^3$
- » Aircraft velocity and altitude
- » Atmospheric temperature and pressure

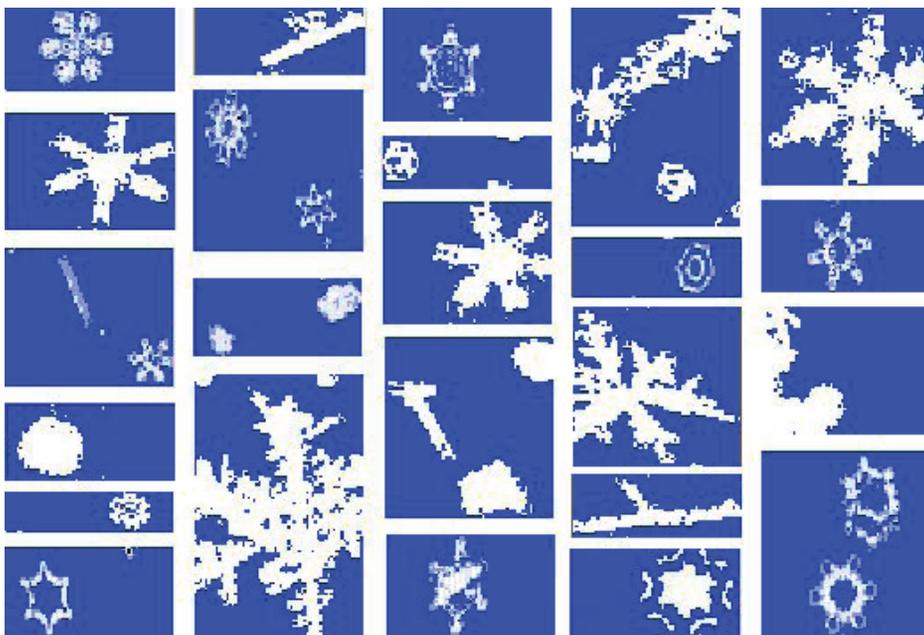
# APPLICATIONS

- » Cloud particle research
- » Climate studies
- » Storm and hurricane research
- » Weather modification
- » Contrails and contrail-induced cirrus
- » Cloud chambers
- » Agricultural and industrial spray characterization

The CIP is suitable for fixed site, mobile or airborne sampling. This instrument replaces the older PMS/PMI 2D-C, 2D-P and KLWC probes.

# IMAGING

The CIP's 64 photodetectors generate high-quality images that allow for easy identification of particle types. The columns, plates, and aggregates below were recorded by researchers at Forschungszentrum Juelich.



# OPTIONAL FEATURES

## FINER RESOLUTION

The CIP is offered in a 15  $\mu\text{m}$  resolution as well as the standard 25  $\mu\text{m}$  resolution.

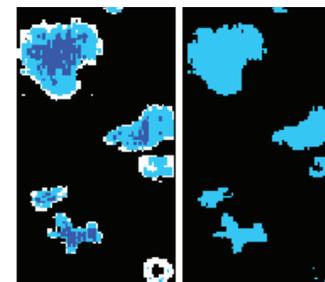
## ANTI-SHATTER TIPS



The CIP can be purchased with special Korolev anti-shatter tips (left). Korolev tips significantly reduce the incidence of particle artifacts in the sample area.

## GRAYSCALE IMAGING

Grayscale imaging provides detail about particle composition that is missed with monoscale imaging. In particular, grayscale imaging gives three levels of shadow recording on each photodetector as opposed to one. The pictures at left show the same particles recorded with grayscale imaging (near right) and monoscale imaging (far right).



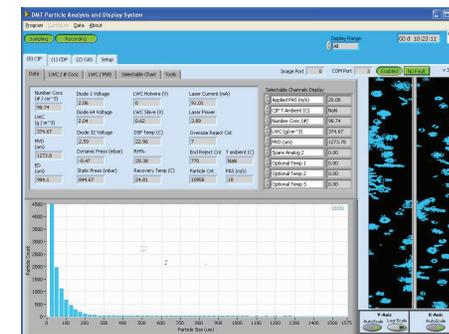
# SOFTWARE

Two optional software packages are available for CIP users. The Particle Analysis and Display System (PADS) allows for instrument control and real-time data display. More information about PADS is given below. The second software package, OASIS, facilitates post-processing particle analysis. More information about OASIS is given on the following page.

PADS displays a user-friendly virtual instrument panel that enables the user to do the following tasks:

- » Start data recording and sampling
- » View real-time particle image data
- » View particle volume and number concentrations, as well as Median Volume Diameter (MVD) and Effective Diameter (ED)

- » View LWC as measured or calculated by the hotwire sensor and CIP
- » Monitor instrument parameters like CIP laser current and various electronics voltages
- » Play back data for post-flight viewing



PADS Software

# CIP SPECIFICATIONS

	CIP	Hotwire LWC (Included)
Technique:	Optical Array Probe with 64 elements: 62 sizing elements, end diode rejection	Temperature-Controlled Hotwire Sensor
Measured Particle Size Range:	12.5 $\mu\text{m}$ – 1.55 mm (for 25- $\mu\text{m}$ resolution CIP) 7.5 – 930 $\mu\text{m}$ (for 15- $\mu\text{m}$ resolution CIP)	N/A; measured LWC range is 0 - 3 $\text{g}/\text{m}^3$
Sample Area:	Variable; depends on tip configuration and particle size	N/A
Upper Concentration Range:	Depends on particle size, but up to 500 particles/ $\text{cm}^3$ for a CIP with standard tips and arm width	3 $\text{g}/\text{m}^3$
Air Speed Range:	10 – 300 m/sec (for 25- $\mu\text{m}$ resolution CIP) 10 - 180 m/sec (for 15- $\mu\text{m}$ resolution CIP)	10 – 200 m/sec
Number of Size Bins:	62	N/A
Sampling Frequency:	1D histogram data: 0.05 to 25 Hz; 2D image data: variable interval, when buffer fills	
Laser:	658 nm, 30 mW	
Calibration Verification:	Spinning glass disk with opaque dots of known size	Not required
Auxiliary Parameters:	Ambient Temperature, Relative Humidity, Static Pressure, Dynamic Pressure	
Data System Interface:	2D CIP data: RS-422, High Speed, 4 Mb/sec Baud Rate System data: RS-232 or RS-422, 56.6 kb/sec Baud Rate	
Optional Software:	Particle Analysis and Display System (PADS) Optical Array Shadow Imaging Software (OASIS)	
Weight:	21 lbs./9.5 kg in DMT canister	
Power Requirements:	<ul style="list-style-type: none"> <li>28VDC: 11A for probe system, anti-ice heaters either 13A (standard tips) or 17A (Korolev tips)</li> <li>Optional AC voltages for system power and anti-ice heaters</li> </ul>	
Environmental Operating Conditions:	Temperature: -40 $^{\circ}\text{C}$ to +40 $^{\circ}\text{C}$ (-40 $^{\circ}\text{F}$ to +104 $^{\circ}\text{F}$ ) RH: 0 – 100%, non-condensing Altitude: 0 - 50,000 ft	
Routine Maintenance:	DMT recommends conducting basic instrument performance checks and inspecting the CIP optical windows before a flight. A weekly calibration check is also recommended.	

Specifications are subject to change without notice.



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