



Leading Edge Associates, LLC

DropVision® AG

Installation & Operations Manual

Version 2.7.1

Manual 1.0

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# DropVision® AG

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## **Product Purpose**

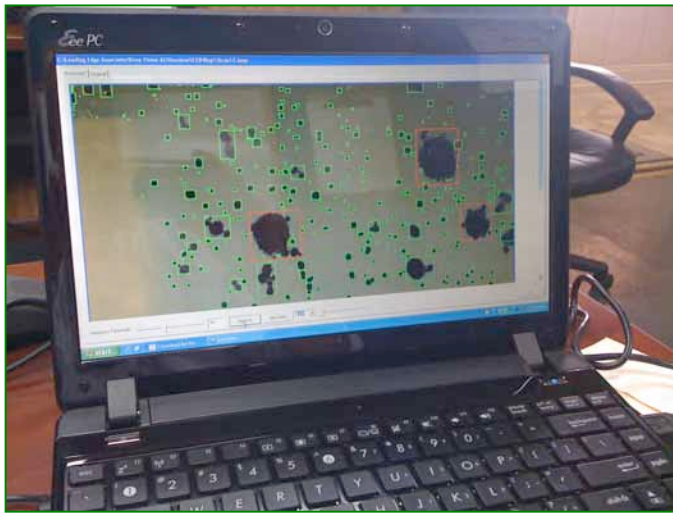
DropVision® AG is designed for the user who applies liquid products that produce larger droplets associated with agriculture, forestry and larvaciding applications.

The droplet range would be defined by *The American Society of Agricultural and Biological Engineers* as ASABE Very Fine through ASABE Course to Very Course.

DropVision® AG provides many advantages unavailable from other technologies. Specifically, DropVision® AG performs swath characterizations, deposition volumes, droplet densities and detailed droplet spectrum analysis.

A very recent addition to DropVision® AG is the ability to monitor off-site drift using a geographical information system (GIS) and TracerVision™.

DropVision® AG through advance software engineered processes scans water, oil or kromekote cards from a field portable scanner, powered by the USB port of a mobile computer. DropVision® AG also provides the feature of analyzing previously scanned images, as those files can be loaded directly into the software. Once the images are loaded, each card can be analyzed individually or automatically processed. This feature is only offered by DropVision® AG and typically processes forty cards in twenty seconds.



The DropVision® AG software demonstrates the advanced software features of qualifying a droplet, by circling the droplet signature with a **green polygon**. **Red polygons** indicate non-qualified droplets. The system operator can click on any individual droplet and exclude it from the results. Another feature is the ability to "crop" an image from each side, top or bottom of the image.

The main software control page will indicated that each card has been processed as indicated by the green icon in the left column and is accompanied with detailed information that includes Sample Number, Distance from center card, Number of Droplets counted, Total Volume, VMD or DV0.5', Droplet Density/cm2 and Volume/Acre. The user can select between metric and US standard.

Completing the analysis of each card, the user can choose to Analyze Set, resulting in the creation of the DV0.1' DV0.5' DV0.9 and the NMD graphs, the Density graphs of Drops/cm<sup>2</sup> and Application Rate Graph. Additionally the COV (coefficient of variation) graph is produced accompanied with a dynamic or live analysis of the effective swath, allowing the user the feature of changing the lane separation and adding up to ten passes. This provides the user the ability to see the deposition results when applying multiple passes in an operational setting.



### More about DropVision® AG

DropVision® AG through engineered processes incorporates proprietary software that eliminates all background particles, only recognizing those droplets that contain a unique fluorescence tracer signature using *TracerVision™*. DropVision® AG electronically captures images contained on the slide, analyzing each droplet while eliminating any background objects or non-qualified droplets. This is accomplished by utilizing advanced proprietary image analysis algorithms only found in **DropVision®** technologies.

**What are the primary components of DropVision® AG**

DropVision® AG consists of a specialized mobile scanner with a built-in dynamic link libraries; DropVision-AG® Advanced Droplet Image Analysis software; and the DropVision-AG® Graphing & Reporting software.

**Does DropVision® AG analyze and report the requirements of the new EPA labels?**

Yes. DropVision® AG provides the user with the new and current label language requirement standards. DropVision® AG specifically incorporates DV.1, DV.5, DV.9, droplet densities per millimeter squared and relative span.

**Does DropVision® AG analyze more than one image?**

Yes. DropVision® AG can analyze one card image or an unlimited number of images from multiple locations or sources. This makes DropVision® AG very unique and capable of analyzing images for a single aircraft calibration or a complex network of droplet collection stations in a wide area ground or aerial application.

**How accurate is DropVision® AG?**

Statistical analysis of DropVision® AG compared to alternative methods, demonstrated comparable results. It should be noted that DropVision® AG through the proprietary image analysis algorithms measures droplet sizes as small as one pixel (52 micron). This advanced and unmatched measuring technique produces a more precise and accurate measurement of droplet sizes as compared to conventional methods.

ASABE is a trademark of The American Society of Agricultural and Biological Engineers

DropVision® is a registered trademark of Leading Edge Associates

***Quick Set-up:***



DropVision® AG will arrive with the software and drivers along with this instruction manual pre-installed on the Netbook and or Notebook purchased with the DropVision® AG system.

To set up and begin operation, ensure that you have connected the USB from the Scanner to your Notebook computer and have inserted the Leading Edge **Key-Lock** in an available USB port.

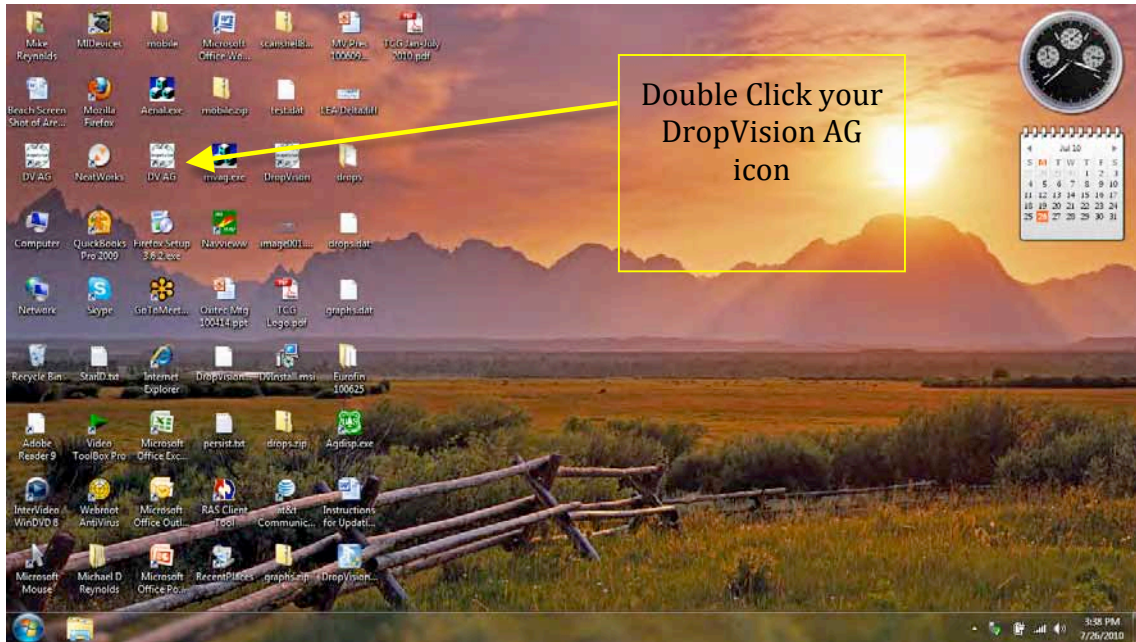


**KEY LOCK**

**SCANNER**



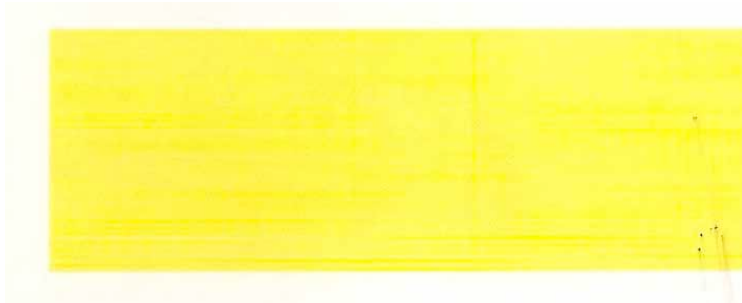
Launch DropVision® AG software by double clicking the DVAG icon located on your desktop.



**Using Water Sensitive Cards for Collection:**

Water-Sensitive Paper is a rigid paper, specially coated yellow surface that will stain dark blue by aqueous droplet impinging on it. Without the addition of dye, just place the papers in the target area before spraying. Following exposure to the

spray the water-sensitive paper will be stained. Upon retrieval and drying, scan the cards with the scanner and software. To the right illustrates a new card without drops and a card once droplets are collected



Placement of Cards illustrated to the left using a measuring tape and flags to identify interval spacing to place cards.

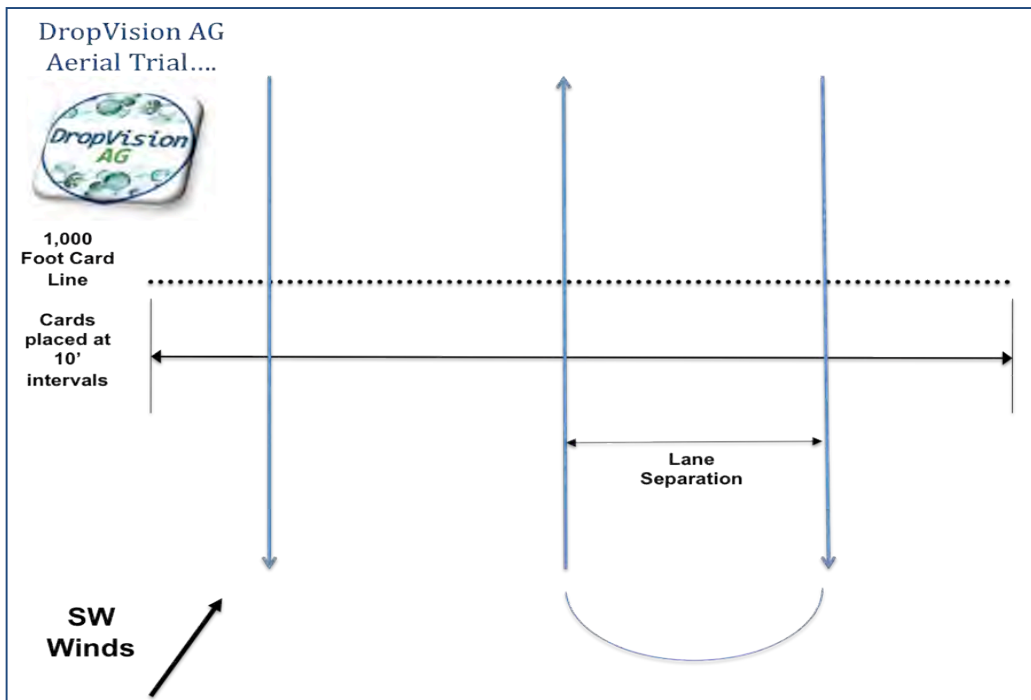
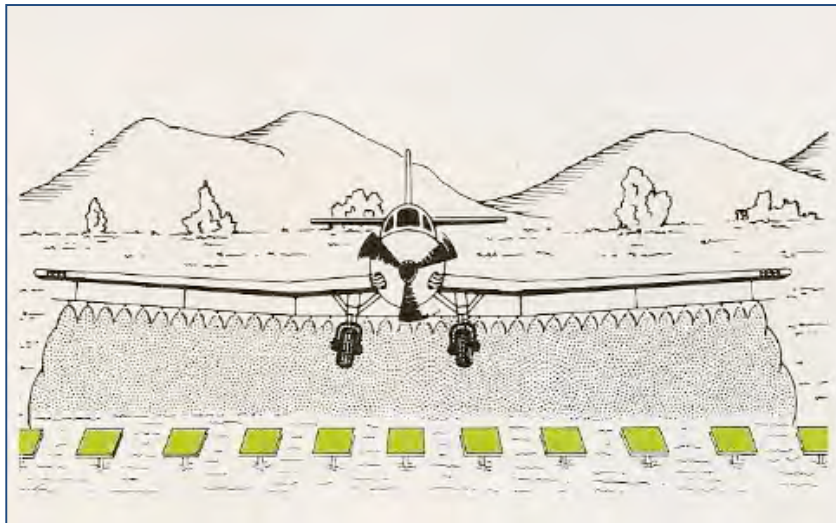


CD cases and clips secure the water-sensitive cards and keep the cards off the moist ground.

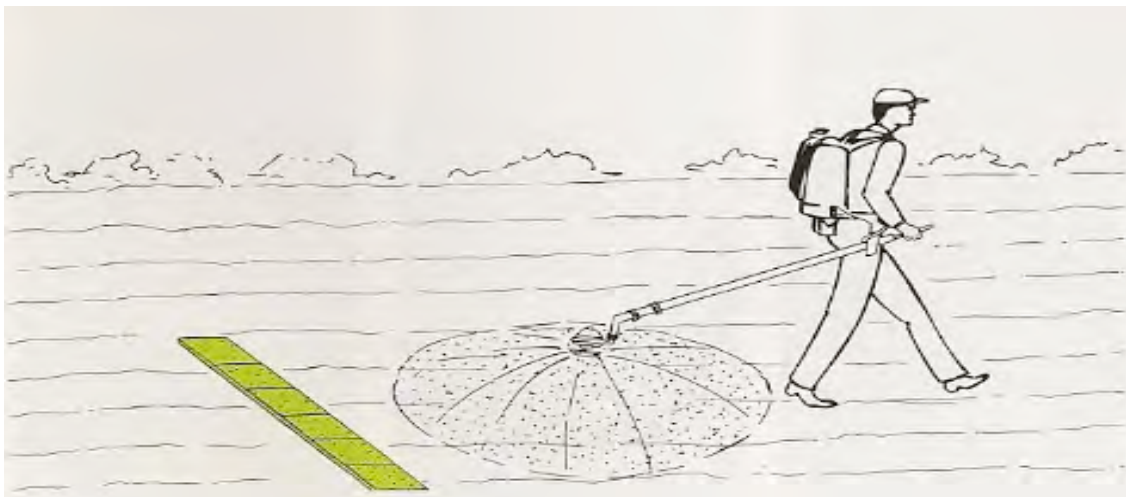
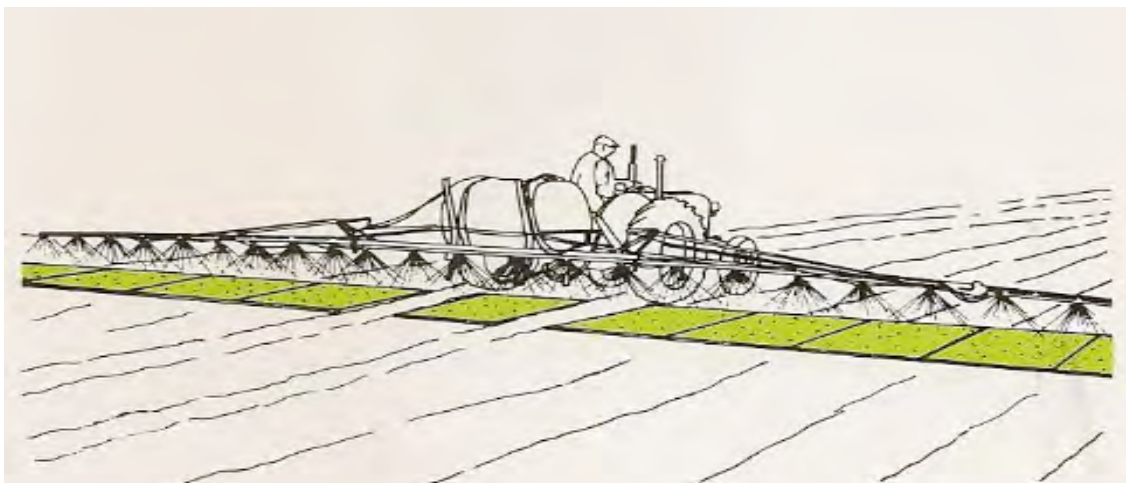
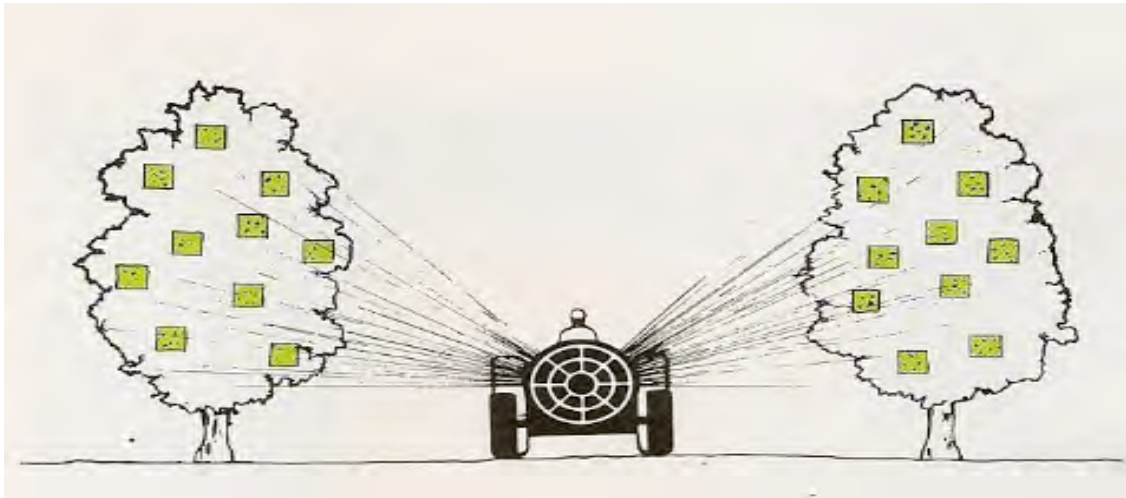
**Application of Cards in the Field:**

Below are several visual examples of applications and setup of the cards in the field.

The two illustrations below demonstrate the set up of a water-sensitive card line. The aircraft is set to fly into the wind, with the cards laid out over a designated card line at designated intervals.



The pictures below illustrate other methods for setting up and collecting of droplets.



**Handling and Storage of Cards:**

Generally, the paper collectors are laid out on an artificial support or stapled directly onto the leaves shortly before spraying. After exposure to the spray, the cards will be stained dark blue. The cards should be retrieved as soon as possible.

- Gloves should be used (polyethylene or rubber) for handling papers to avoid staining and contamination of the card.
- The collector support (natural or artificial) must be dry, the cards should not be laid out in the field while plants are still wet from morning dew or rain.
- The collection surface must not be scratched before use.

**Storage and Conservation:**

- Shelf life – packed in its original sealed alubags, cards can be stored for up to ten years provided that the seal and bag remain undamaged.
- Cards must be stored before and after spray exposure under dry conditions in airtight bags or boxes.
- Exposed cards can be protected with a colorless, thin adhesive foil. Avoid air pockets when applying the foil.
- Aerosol sprays of colorless, synthetic resin can also be used. The pH value of the resin must be in the range of 4.5 to 6.0.

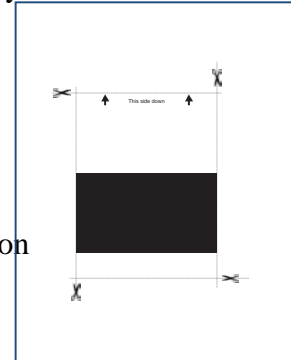
**Application of Cards in the Field:**

Below are several visual examples of applications and setup of the cards in the field.

## Calibrate the Scanner

**SCANNER CALIBRATION** - Scanner calibration resets the scanner color sensor and generates higher accuracy in the OCR detection process. When you use the scanner for the first time, you will be prompted to calibrate the scanner. Calibrating the scanner is also a good idea if you notice deterioration in scanning and OCR quality.

1. Click the 'Calibrate Scanner' button.
2. Insert the calibration paper that came with the scanner.
3. Click OK.



**CLEANING THE SCANNER** - It is a good idea to clean the scanner from time to time, especially if you notice irregularities and deterioration in scanning and OCR quality.

1. Click the 'Clean Scanner' button.
2. Insert the cleaning paper that came with the scanner. You can add a few drops of alcohol or cleaning solution to the cleaning paper.
3. Click OK.



This screen is launched to begin the Calibration process.



Once the Calibration paper is inserted the scanner will begin Calibration and provide you a Progress Bar.



This screen will appear once the Calibration is complete.



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**Menu Bar:*****File, Settings, View, Replications, Actions & Help*****DropVision® AG Advanced Droplet Image Analysis Software**

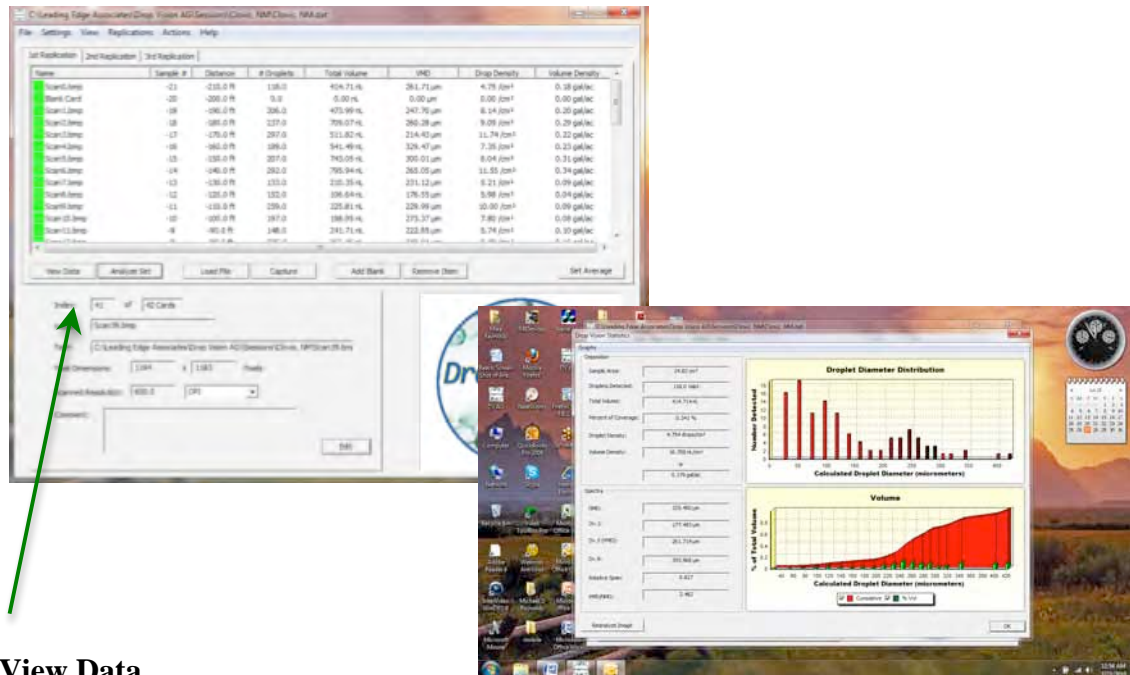
## 1. File

- a. New – Select to create a New Session. Insert name of project in the Session Name box and verify location of file. Suggested file route should be C:/LeadingEdgeAssociates/DropVisionAG/Sessions. Click OK.
  - i. Session Details Screen will launch whereby you can input all the related details about the project to include:
    1. Instance; Date, Time Location
    2. Aircraft; Tail Number, Type, Pilot, Owner
    3. Environmental; Wind Speed, Wind Direction, Temperature, and Humidity.
    4. Nozzles; Type and Number
    5. Product; Name, Active Rate, Spray Rate, Spray Solution Type – Neat or Tank Mix
    6. Block; Spray Height, Spray Speed, Block Pattern (Race Tracking or Back and Forth
    7. Sampling; Card Width, Card Height, Card Classification (Kromkote, Oil or Water) Distance between Sample Cards and Swath
    8. Spread Factor; Actual/Stain, Stain/Actual or Equation  
**Polynomial Expression:  $d/(1.633+(.0009*d)+(0*d^2))$**
- b. Open – Launches Open window to search for and launch previously saved project file. File data will be held in a “dat” file.
- c. Save As – Select to save project. Typically recommended to save in predefined route directory
- d. Close – Selecting Close will shutdown the software program

## 2. Settings

- a. Session Details: As described above in items 1 through 8.
- b. Configuration – This screen allow you to determine which units of measure you would like to display result for your project to include:

- 
- i. Droplet Diameter
    - ii. Area (Block Level)
    - iii. Area (Card Level)
    - iv. Volume (Block Level)
    - v. Volume (Card Level)
    - vi. Imagery; Max Stain Diameter (Pixels)
  3. View
    - a. Thumbnails – Selecting Thumbnails allow you to view the card images rather than card details
    - b. Combine Replications – Selecting this function allows you to combine and average the result of your replications.
  4. Replications
    - a. New Replication – Provides you the ability to process collections of cards for each aircraft flyover. For example, if you have two aircraft that made three flights over your card line, you collected three sample sets of cards. Using this function allows you to scan, analyze and produce reports for each fly over and card set. Later, you will be able to select combine to average the replications.
    - b. Remove – Provide you the ability to remove one or more replications.
  5. Actions
    - a. View Report – Provide detailed reporting as illustrated below for the combined replications.
    - b. Batch Process – Provides the ability to analyze all images using the same settings, thereby providing a quick analytical tool to process images.
    - c. Unprocess All – Allows you to redo or reprocess images.
  6. Help
    - a. About – Illustrates the Version, Copyright date and Leading Edge Associates, LLC Company name.

**Screen Selections from Main Menu:****View Data**

Selecting View Data, allow you to see the entire spectrum of statistical data associated with that one card. Additionally, it provides you the option of re-analyzing the card. It provides you the following:

1. Deposition
  - a. Sample Area
  - b. Droplets Detected
  - c. Total Volume
  - d. Percent of Coverage
  - e. Droplet Density
  - f. Volume Density
2. Spectra
  - a. NMD
  - b. Dv.1
  - c. Dv.5 (VMD)
  - d. Dv.9
  - e. Relative Span

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f. VMD/NMD

### **Analyze Set**

Selecting the Analyze Set button provides you three graphical representations of your card analysis. The graphs include:

1. **Spectra**; measuring Diameter and Distance Relative to Aircraft Centerline
2. **Density**; measuring drops/cm<sup>2</sup>, gal/ac and Sample Card Distance Relative to Aircraft Centerline
3. **Coefficient of Variation**; providing COV to Swath Width
4. **Volume Deposition Estimations**; providing gal/ac to Distance From Block Edge.
  - a. **Please note that on this Graph you can adjust the Number of Passes located on the bottom left and Lane Separation Distance located on the bottom center of the graph.**
  - b. **Additionally, you can set the units of measure in the Session Details.**

### **Load File**

Pressing the Load File key allow you to recall and populate prior images or projects to analyze and view graphics. Once you select Load File, you will see box with the C Directory populated, double click on Leading Edge Associates, then double click on DropVision AG, then double click on Session and double click on the project you would like to retrieve.

### **Capture**

As you place the card in the Scanner, pressing the Capture button processes the card and creates an image in the Main Menu.

### **Add Blank**

This allows the operator the option to insert a blank card in the event the cards located on the end of the card line does not capture drops. Thus inserting a black card will allow you to maintain your statistical count of cards and preserve the analysis.

### **Remove Items**

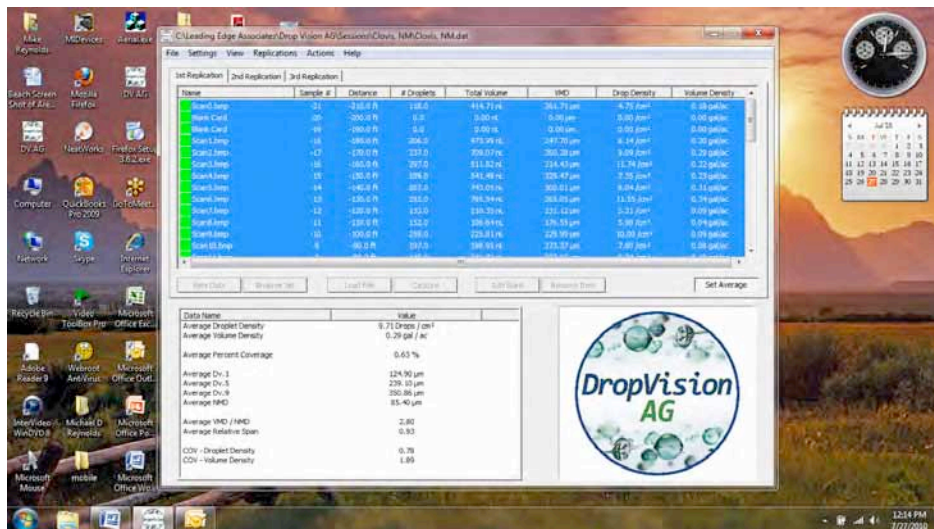
This button allows you to remove cards for the purpose of rescanning.

### **Set Averages**

This button calculates the averages for the card set in any replication as illustrated below. This produces the following statistical summary:

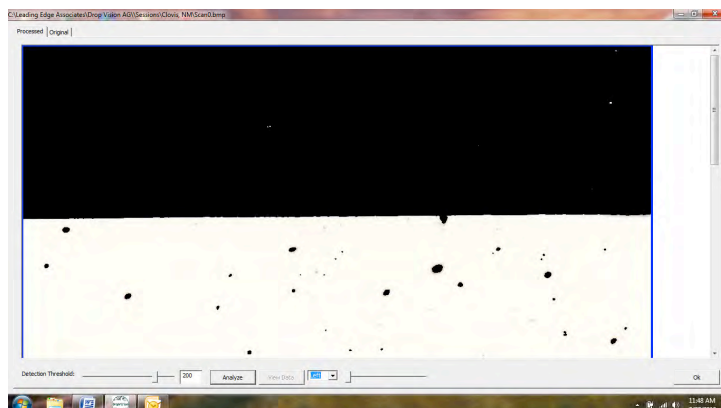
1. Average Droplet Density

2. Average Volume Density
3. Average Percent Coverage
4. Average Dv.1
5. Average Dv.5
6. Average Dv.9
7. Average NMD
8. Average VMD/NMD
9. Average Relative Span
10. COV Droplet Density
11. COV Volume Density



### Detection Threshold

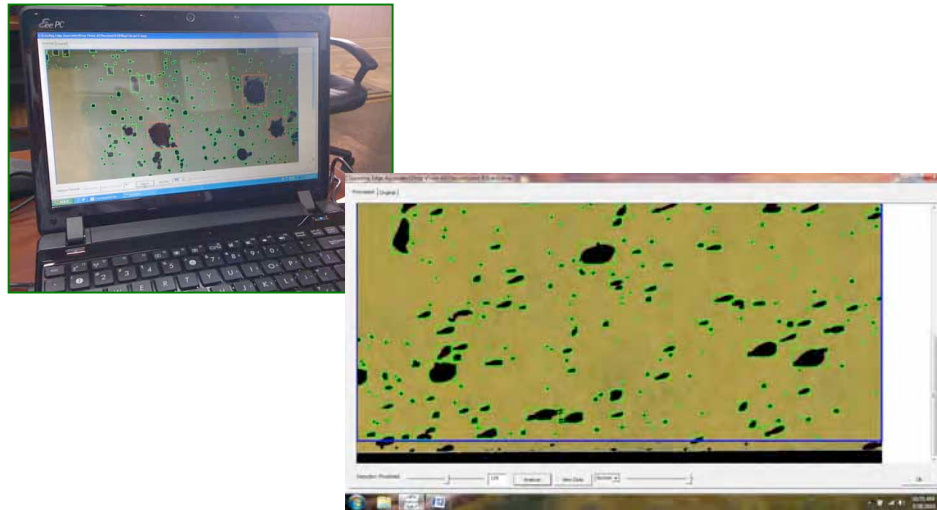
This feature allows the operator to essentially focus on the droplets indicated on the screen. By sliding the bar to either the left or right, one can refine the droplet image to eliminate shadowing and provide greater clarity. The number to the right of the Slide Bar provides and indices, in which you can record, leave in



place for other cards and or type in the number in the box.

### Analyze

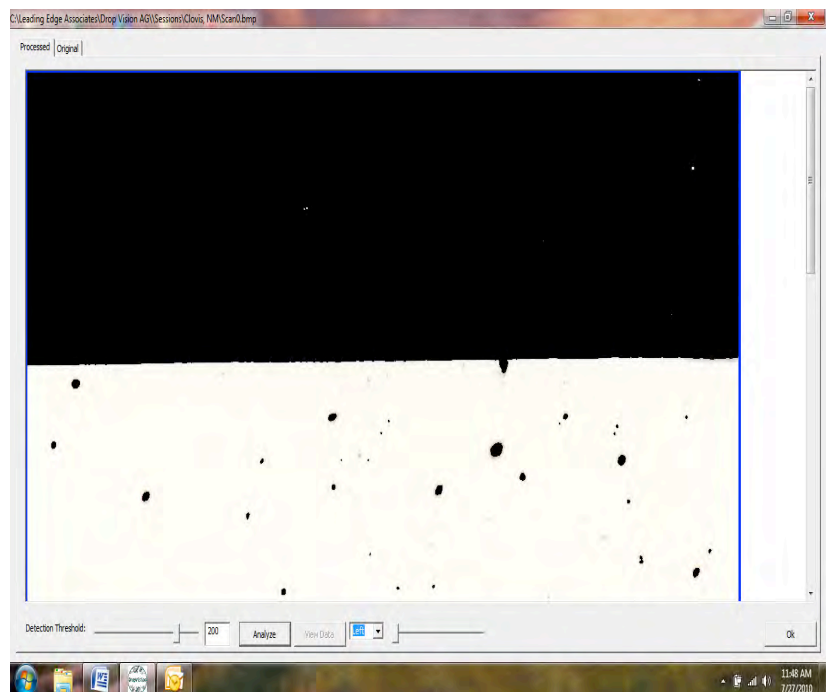
In this screen above, clicking the Analyze button begins the process of analyzing droplets. Upon completion, you will see a screen with green polygon drawn on qualified drops.



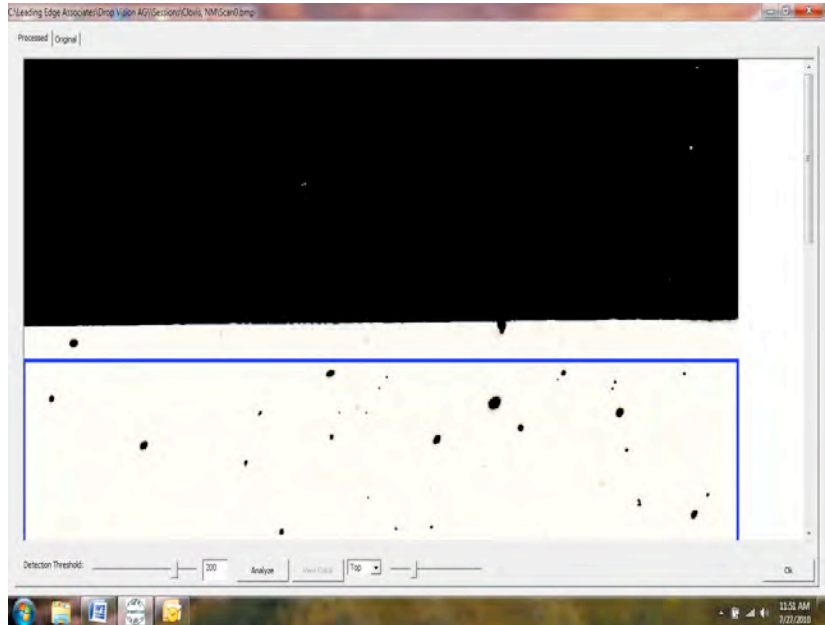
### Cropping Procedure

Located in the center of the screen to the right, you will see two boxes; one indicating “Left, Right, Top and Bottom”.

To the right of the directional box, you will find a Slide Bar. Once you have selected the location on the card to crop, simply slide the Crop Bar to the right to crop out sections of the card that was damaged or as in this illustration not scanned properly.



You will see a Blue bar across the vertical or horizontal portion of the screen, which indicated the portion of the card that has been cropped out of the analysis.

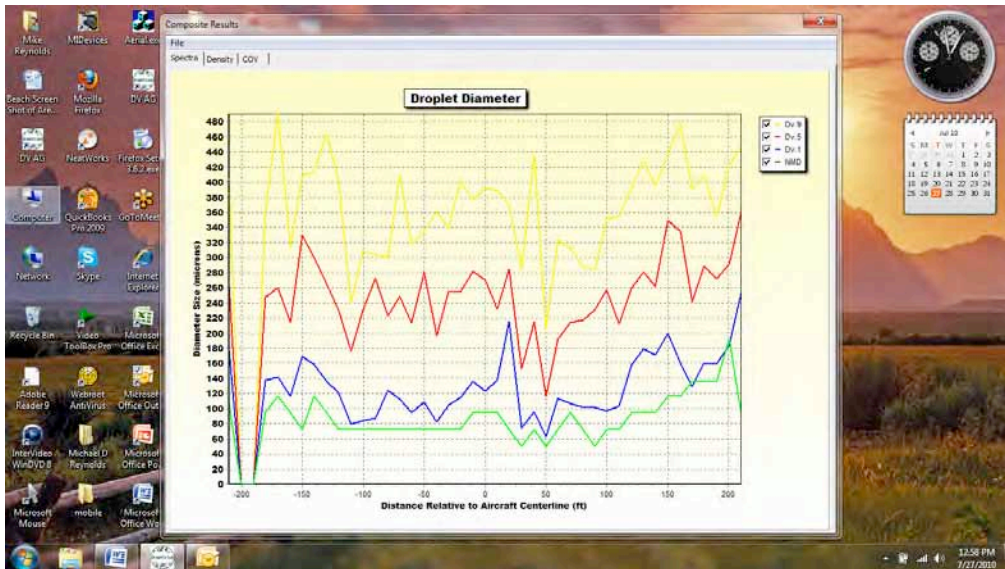


**DropVision® AG Graphing and Reporting Software**

**SECTRA**

Illustration A below provides you Droplet Diameter comparing Diameter Size and Distance Relative to Aircraft Centerline.

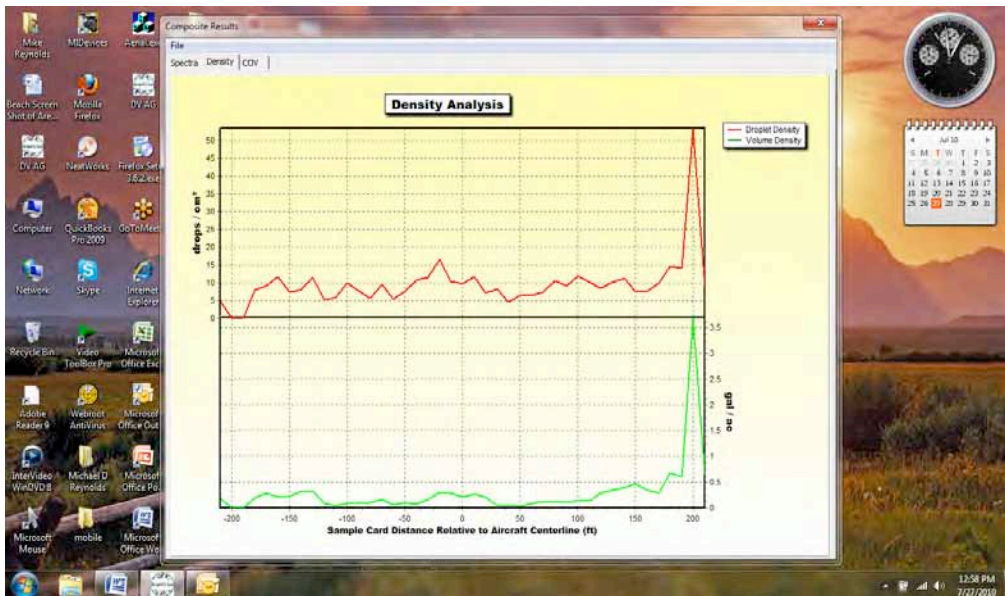
A



**DENSITY**

Illustration B below provides Droplet Diameter comparing drops/cm<sup>2</sup> and Sample Card Distance Relative to Aircraft Center Line.

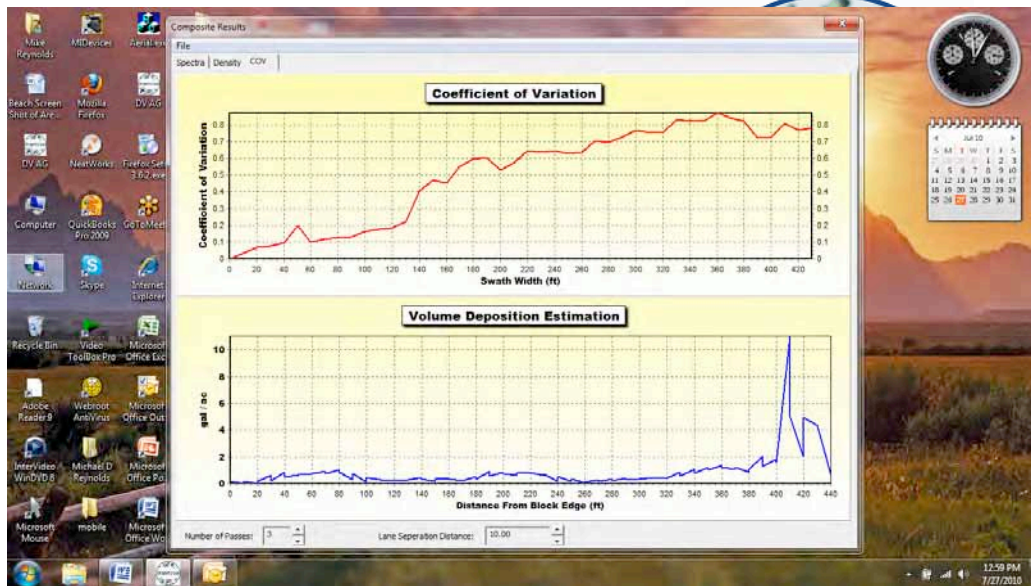
B



**COV**

Illustration C provides both the Coefficient of Variation and Volume Deposition Estimation.

C



<b>Nozzle Type:</b> Super	<b>Distance Between Samples:</b> 10.00 m
<b>Number:</b> 3.00	<b>Spread Factor:</b> .5
<b>Product:</b> Bug Killer	<b>Swath Pattern:</b> Race Tracking
<b>Active Rate:</b> 3.00 gal / ac	<b>Swath Width:</b> 0.00 m
<b>Solution Type:</b> Neat	<b>Spray Height:</b> 40.00 ft
<b>Spray Rate:</b> 13.00 oz / ac	<b>Spray Speed:</b> 50.00 mph

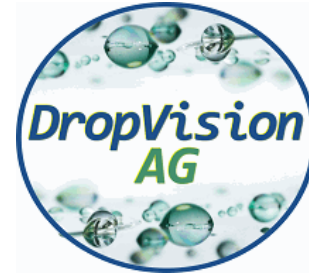
**Average Values Across all Replications**

<b>Avg Dv.1</b>	133.49 µm	<b>AvgNMD</b>	31.75 µm
<b>Avg Dv.5</b>	730.08 µm	<b>Avg Relative Span</b>	1.28
<b>Avg Dv.9</b>	1,071.03 µm	<b>Avg NMD/VMD</b>	25.81
<b>Avg Total Volume</b>			0.00 gal
<b>Avg % Coverage</b>			0.01
<b>Avg Drop Density</b>			66.41 nL/cm <sup>2</sup>
<b>Avg Volume Density</b>			0.71 gal/ac

DropVision® AG system will create a complete report with each slide's particular statistical analysis and the following Summary Report

# DropVision AG

## Session Report



<b>Date:</b>	07/27/2010	<b>Temperature:</b>	73.00 °F
<b>Time:</b>	1:34pm	<b>Wind Speed:</b>	6.00 mph
<b>Location:</b>	Field 1	<b>Wind Direction:</b>	70.00 Degrees
<b>Aircraft Tail:</b>	123456z	<b>Humidity</b>	20.00 Percent
<b>Aircraft Type:</b>	Space Shuttle	<b>Sample Card Type:</b>	Kromekote
<b>Pilot:</b>	John	<b>Sample Card Width:</b>	7.62 cm
<b>Owner:</b>	Joe	<b>Sample Card Height:</b>	5.08 cm
<b>Nozzle Type:</b>	Super	<b>Distance Between Samples:</b>	10.00 m
<b>Number:</b>	3.00	<b>Spread Factor:</b>	.5
<b>Product:</b>	Bug Killer	<b>Swath Pattern:</b>	Race Tracking
<b>Active Rate:</b>	3.00 gal / ac	<b>Swath Width:</b>	0.00 m
<b>Solution Type:</b>	Neat	<b>Spray Height:</b>	40.00 ft
<b>Spray Rate:</b>	13.00 oz / ac	<b>Spray Speed:</b>	50.00 mph

### Average Values Across all Replications

<b>Avg Dv.1</b>	133.49 µm	<b>AvgNMD</b>	31.75 µm
<b>Avg Dv.5</b>	730.08 µm	<b>Avg Relative Span</b>	1.28
<b>Avg Dv.9</b>	1,071.03 µm	<b>Avg NMD/VMD</b>	25.81
<b>Avg Total Volume</b>	0.00 gal		
<b>Avg % Coverage</b>	0.01		
<b>Avg Drop Density</b>	66.41 nL/cm <sup>2</sup>		
<b>Avg Volume Density</b>	0.71 gal/ac		

**Scanner Specifications:**Dimension

L x W x H: 7.5" x 2" x 1.7" (190mm x 51mm x 44mm) Weight: 8.4 ounce (240g) Cable length: 60 inches (152cm), detachable

System Requirements

Windows Vista, XP, 2000, ME, & 98SE Pentium 100MHz or higher CPU 64MB of DRAM or above VGA monitor with true color and at least 800x600 pixels 60 MB free disk space

One USB port A CD-ROM drive

Image sensor: Linear color CMOS Optical Resolution: 600 dpi Interface: USB 2.0 (High speed) Power Consumption: 0.2W Stand-by, 2.0W during Scan, fully USB powered.

Scanning Area: 4.13" x 10" (LXW) (105mm x 254mm) 6 format

Scan Speed: 6 ppm (page per minute) B&W, 3 ppm color Scan Modes: 48-bit color (internal), 24-bit color (output), 8-bit grayscale, 1-bit

B&W Paper Sensor: Electro-Mechanical Paper Thickness: 0.1mm to 1.5mm

Regulatory Requirements: FCC Class B, CE, USB-IF.org

Environmental Requirements: WEEE, RoHS

**Contact Information**

Leading Edge Associates, LLC

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[www.leateam.com](http://www.leateam.com)

**Service, Parts, Warranty - Scanner Customer Service**

If you have any need for troubleshooting, maintenance questions, problems or need parts, replacements, accessories concerning your scanner product please send an email to: [office@LeaTeam.com](mailto:office@LeaTeam.com)

Please remember to register your Scanner upon receipt.

# DropVision® AG

