# Ground ULV and Equipment Calibrations

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# History of Thermal Fogging

- WWII Technology (Smoke Screen Generators)
- Mix of Insecticide and Carrying Agent (usually diesel or kerosene)
- Good Control in Heavy Vegetation
- Creates Traffic Hazards
- Environmental Considerations: 40 gal/hr of oil/diesel

# Thermal Fogging

# 1946

Todd Shipyard made the first thermal mosquito fogger by down sizing a smoke generator that the Navy used to hide ships during World War II.  DDT was the first adulticide used and was mixed with Kerosene.


SOUTH CAROLINA STATE BOARD HEALTH
3100 Chevrolet


FOG

Don’t forget to turn off the pilot light!

# Thermal: Truck-Mounted

# Thermal: Handheld

# History of ULV Aerosols

- Developed during the 1960's
- 1970's, ULV Papers presented by Dr. Gary Mount at state and national meetings
- Comparable Efficacy with Thermal Fogging
- Use approximately 1-4 gal/hr

# 1966

The first ULV machine was developed as a joint project between the U.S. Navy Jacksonville, Florida and the U.S. Department of Agriculture.

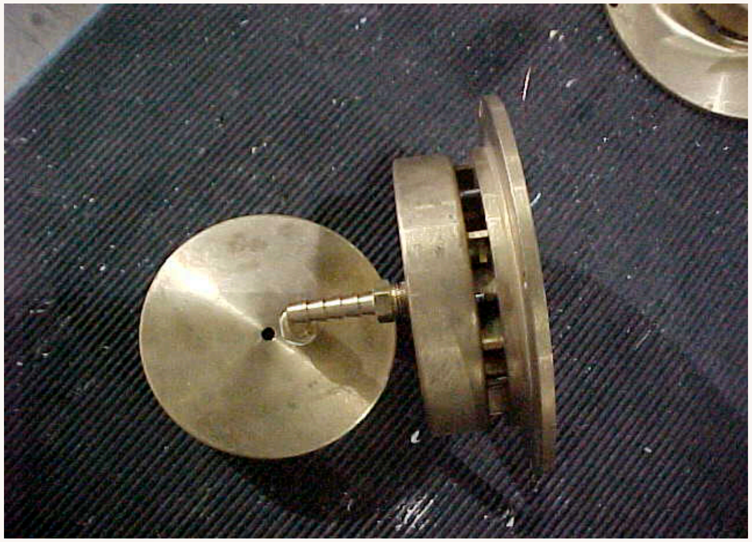
# Thermal vs. ULV

- Comparable Efficacy
- Thermal can provide good penetration
- ULV is Less Offensive and Less hazardous
- Most products and application methods used today were developed using ULV
- ULV uses much less total volume

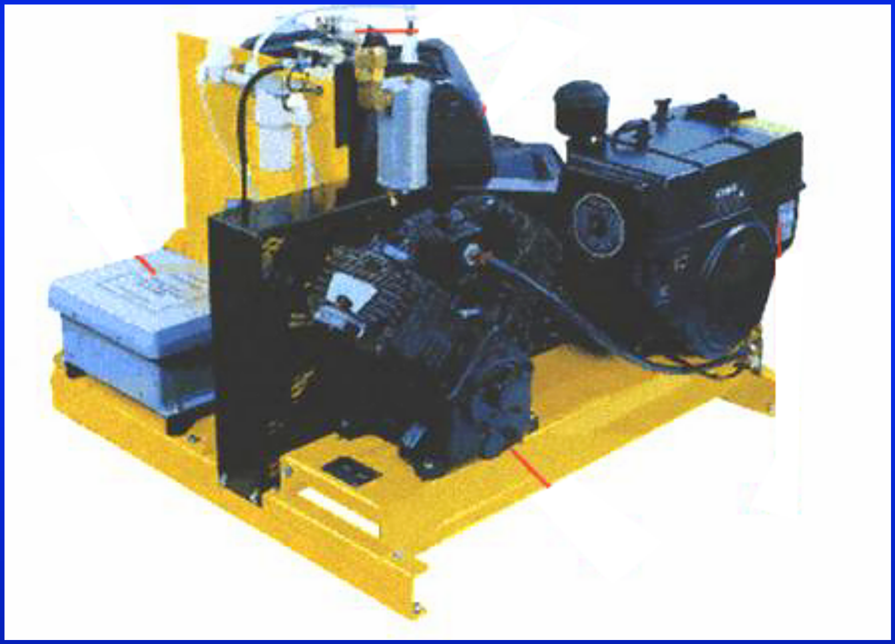

# Volume Reduction

# ULV: Truck-Mounted

# Basic ULV Types: Low Pressure



# Basic ULV Types: High Pressure



# Basic ULV Types: Rotary Atomizers

# ULV: Gas Handheld


# ULV: Backpack


# ULV: Portable Units

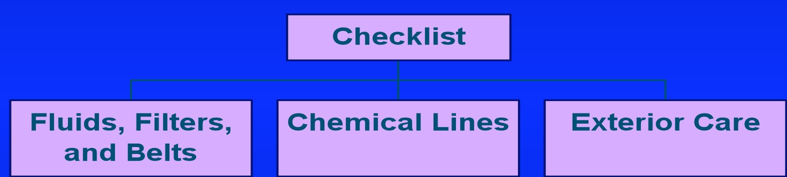
# ULV: Multi-Purpose Sprayers


# ULV: Truck-Mounted


# ULV: Electric Foggers


# ULV: Aerial

# Maintenance



# Fluids, Filters, and Belts

- Fluids: engine oil, blower oil, grease fittings
- Filters: oil filter, chemical filter, air filter
- Belts: check tension and wear

# Chemical Lines

- Check all lines and fittings regularly for leaks
- Watch for dry or brittle lines
- Replace lines as needed

# Exterior Care

- Wash and degrease occasionally
- Repaint surfaces as necessary
- Replace worn or damaged parts

# Components of a Calibration

1. Determine desired chemical application rate from product label

2. Verify correct chemical flow rate and calibrate equipment

3. Verify droplet size (VMD or MMD) and range

# Calculations- label information

- Labels usually provide lbs of active per gallon
- Provide maximum rates of application
- Provide types of applications that may be done, i.e. ULV, thermal, barrier
- Provide max application limits, i.e. pyrethroids are usually 0.007 per acre
- Aerial directions may contain some limitations

# Calculations for Equipment Calibration

Calculations are based on length times width times speed

If swath is assumed to be 300 ft wide and the vehicle is
Driven at 10 miles per hour:
10 mph x 5,280 = 52,800 x 300 feet = 15,840,000 ft²
Then 15,840,000 ft² ÷ 43,560 ft² per acre = 363.6 acres
363.6 acres per hour ÷ 60 = 6.06 acres per minute

# Calculations for Equipment Calibration

- It isn’t necessary to do these calculations over and over!
- Calibrations are usually based on 10, 15 or 20 mph
- The acreage at each mph is a set value
- A simple two or three step method can be used for most calculations

# Calculations for Equipment Calibration

| Vehicle Speed | Acres/minute |
|---|---|
| 5 mph | 3.03 |
| 10 mph | 6.06 |
| 15 mph | 9.09 |
| 20 mph | 12.12 |

# Calculations: Product cost

- How much does a product actually cost per pound?
- → Divide cost per gallon by lbs of active per gallon

  Example A: Product costs $170 per gallon, each gallon contains 1.75 lbs of active, so: $170 ÷ 1.75= $97.14 per lb

  Example B: If a product costs $29 per gallon, and each gallon contains 0.29 pounds of active, cost is $100 per lb

# To Find Cost Per Acre

1. Divide cost per gallon by lbs of active per gallon
2. Multiply times desired active per acre

* *for mixed products add cost for solvent oil then calculate 1. based on a mixed gallon*

# To find active per acre

1. Divide active per gallon by 128 (ounces)
2. Multiply active per ounce times ounces per minute
3. Divide by acres per minute

*For mixed products, to find 1. divide active per gallon of concentrate by total gallons of mix then divide by 128*

# To find ounces per minute, for calibration of equipment

1. Multiply desired active per acre x acres per minute (from vehicle speed)
2. Divide by lbs of active per ounce

*For mixed products, to find 2. divide by lbs of active per ounce of diluted product*

# Why Calibrate?

- You must meet legal requirements for application of any pesticide
- Verify actual amount of chemical applied to comply with product labeling
- Get best results from chemical applied

# Verifying Flow Rate: Materials

- Personal Protective Equipment: gloves and goggles
- Graduated cylinder (preferably in ml)
- Extra collection container
- Stopwatch
- Any special tools required: i.e. screwdriver, wrench, allen wrench, etc.

# Verifying Flow Rate: Chemical Measurement Method

- Push vs. Pull systems: does your flow control system have a pump or does it rely on orifices?

- This determines whether you can measure the output at the nozzle (amount collected) or you must measure the intake (amount used).

# Verifying Flow Rate: General Rules

- When possible, always take the final measurement with the engine running, as system voltage may affect pump output. Calibration of orifice systems *must* be done with the engine running.
- Measure output for at least 1 minute.
- Make sure all air is removed from the lines and filters before you start.

# Pumping Systems

- Flow Meters
- SCAMP
- Leco VF and CV
- ELF
- Monitor 1,2, and 3, Accuflow, GeoFlow
- SmartFlow
- Sentinel GIS

# Pumping Systems

- Generate reports of spraying operations
- Can track vehicles using GPS
- Monitor chemical application
- Download capability
- Real-time tracking of vehicles
- Can now use mobile devices, PDA's to collect data for chemical applications, Sentinel GIS

# Droplet Sizing: Why Droplet Size?

- Maintain maximum level of efficacy
- Meet label/legal requirements
- Recent labeling of mosquito control products requires a specified range of droplet sizes in microns

# 2005-1 droplet label statement

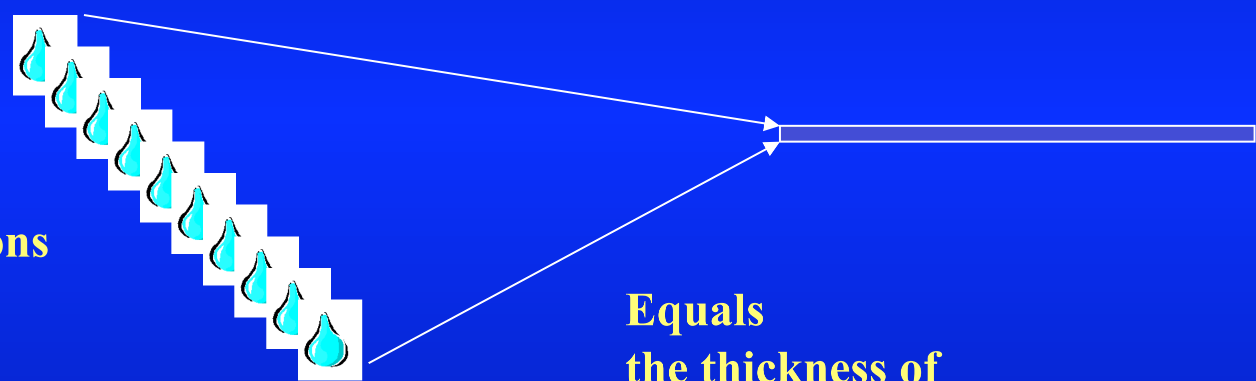
- "*Spray equipment must be adjusted so the volume median diameter or mass median diameter is less than 30 microns (Dv0.5<30µm) and that 90% of the spray is contained in droplets smaller than 48 microns (Dv0.9<48µm).*"
- The best way to do this is with a DCIII !!!!

# An Aerosol Compared to:

| Size of Drops (μ) | Type of Drop | Example |
|---|---|---|
| 1000 | Moderate Rain | Ag. Sprays |
| 500 | Light Rain | Medium Ag. Sprays |
| 200 | Drizzle | Fine Ag. Sprays |
| 50-100 | Mist | Sidewalk Mister |
| 30 | Cloud Particles | Cumulus |
| **10-20** | **Aerosols** | **Cold Foggers** |
| 1-5 | Smoke | Thermal fogger |

# What is a micron?

A tiny something?
1/25,000 inch (25,000 per inch)!



**10 drops**
**each 10 microns**

**Equals**
**the thickness of**
**one sheet of paper**

# Why are small drops (<30 microns) effective and large drops (>48 microns) less effective?

- Larger drops fall out of the air mass more rapidly.
- A 100 micron drop will fall 100 feet in two minutes.
- A 20 micron drop will fall 100 in one hour.
- Large drops may have negative effects on the environment
- Large drops deposit out in relatively higher concentrations.
- One 20 micron droplet will make eight 10 micron droplets

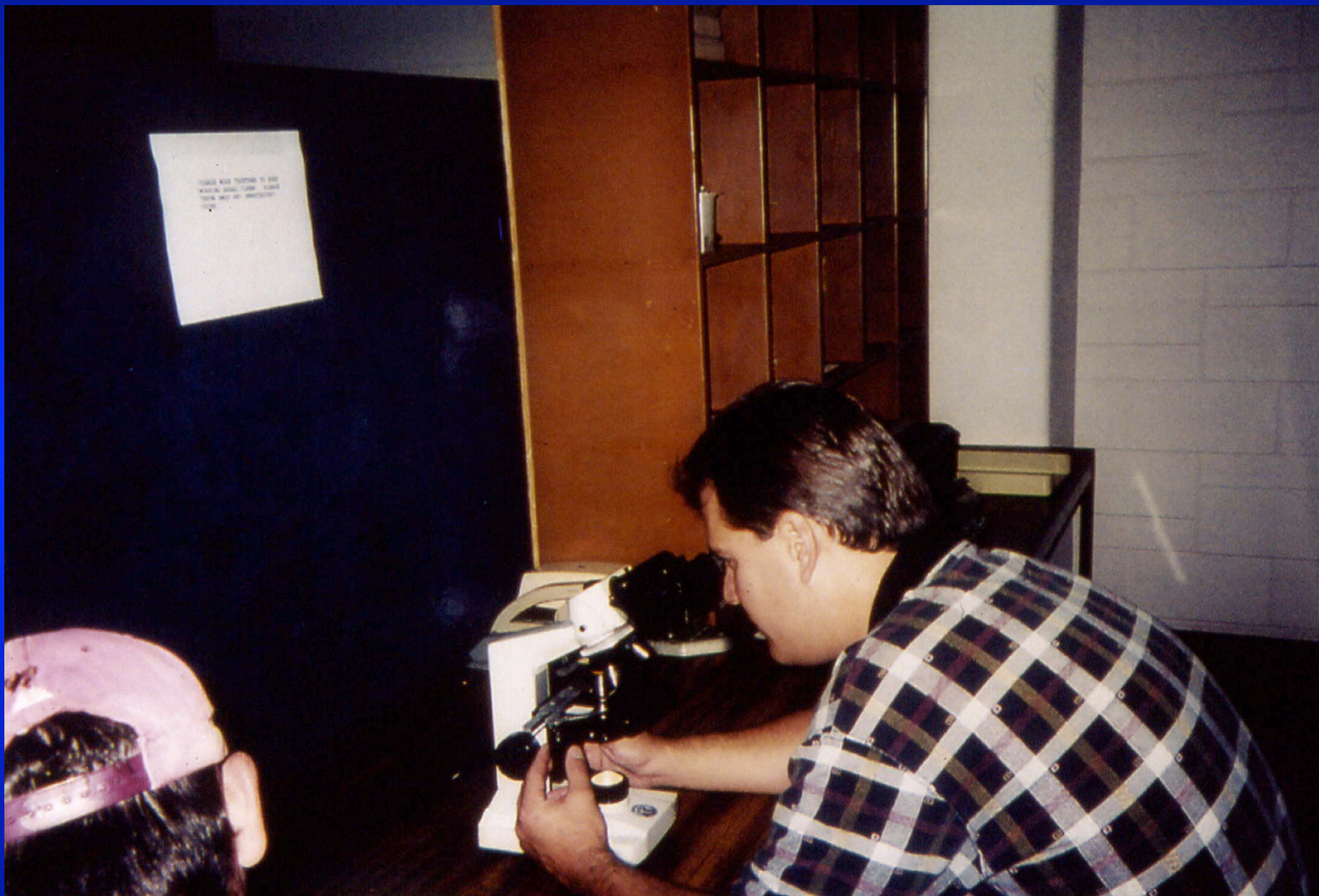
# Droplet Sizing: AIMS or "Hotwire" Unit

- Very easy to use
- Can be done very quickly
- Best suited for performing multiple tests
- Moderately expensive
- Probes are very delicate and can be broken easily
- Most accurate way of "in the field" sizing


DC-III
KLDLABS
KLDLABS

# Droplet Sizing: Waved Teflon-coated Slides

- Commonly used method
- Least expensive method
- Very time consuming
- Complex calculations
- Not very accurate!
- Accuracy depends on person reading slide

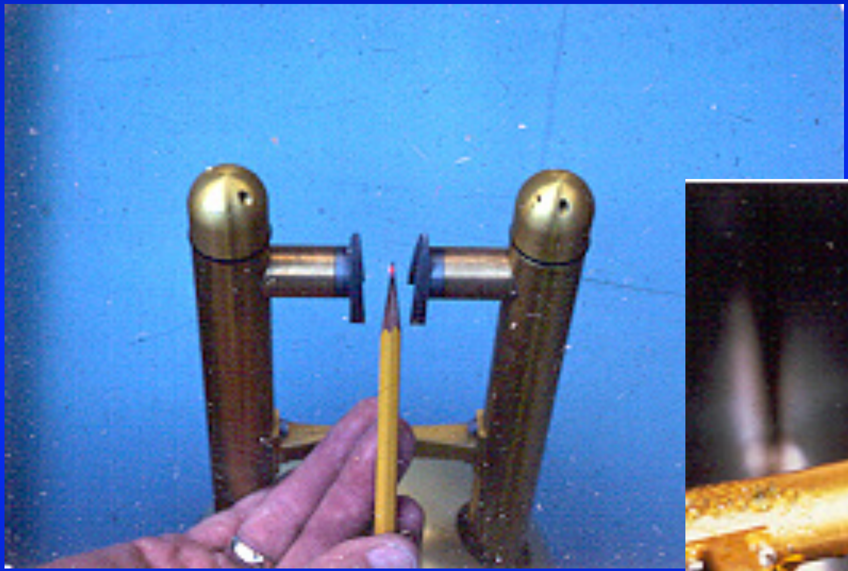


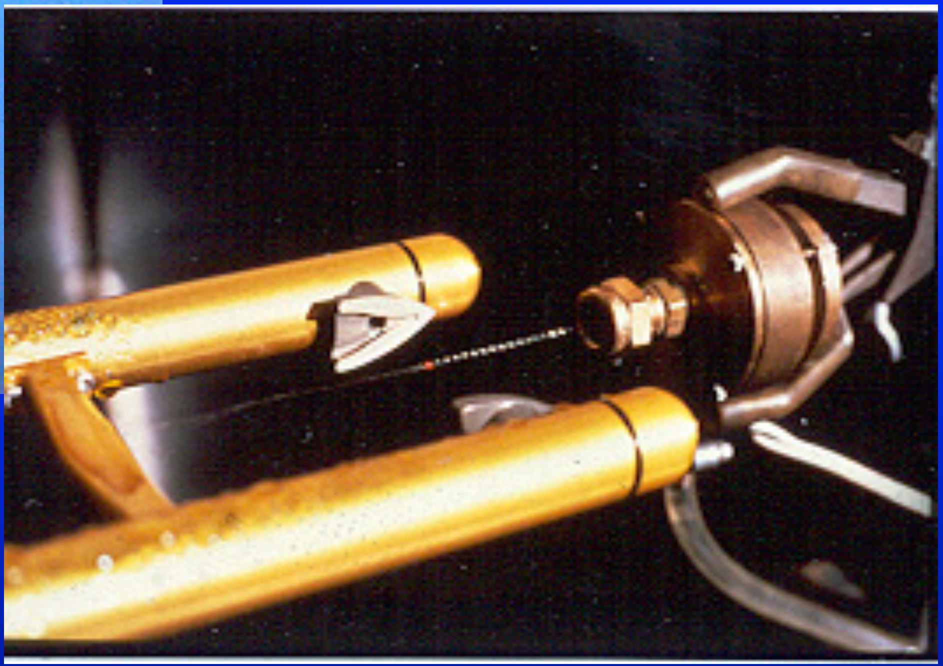
# Rotated Slides

# Droplet Sizing: Laser

- Most Accurate
- Very, Very Expensive
- Not Practical for drop sizing vehicle mounted ULV sprayers

# Droplet Sizing: Laser





# Adulticiding Basics

- Cloud of insecticide move by a breeze
- Droplets must impinge on adult mosquitoes
- Droplets must be small enough to provide adequate drift
- Droplets must contain enough active to kill an adult mosquito

After considering equipment, product, and droplet size…..

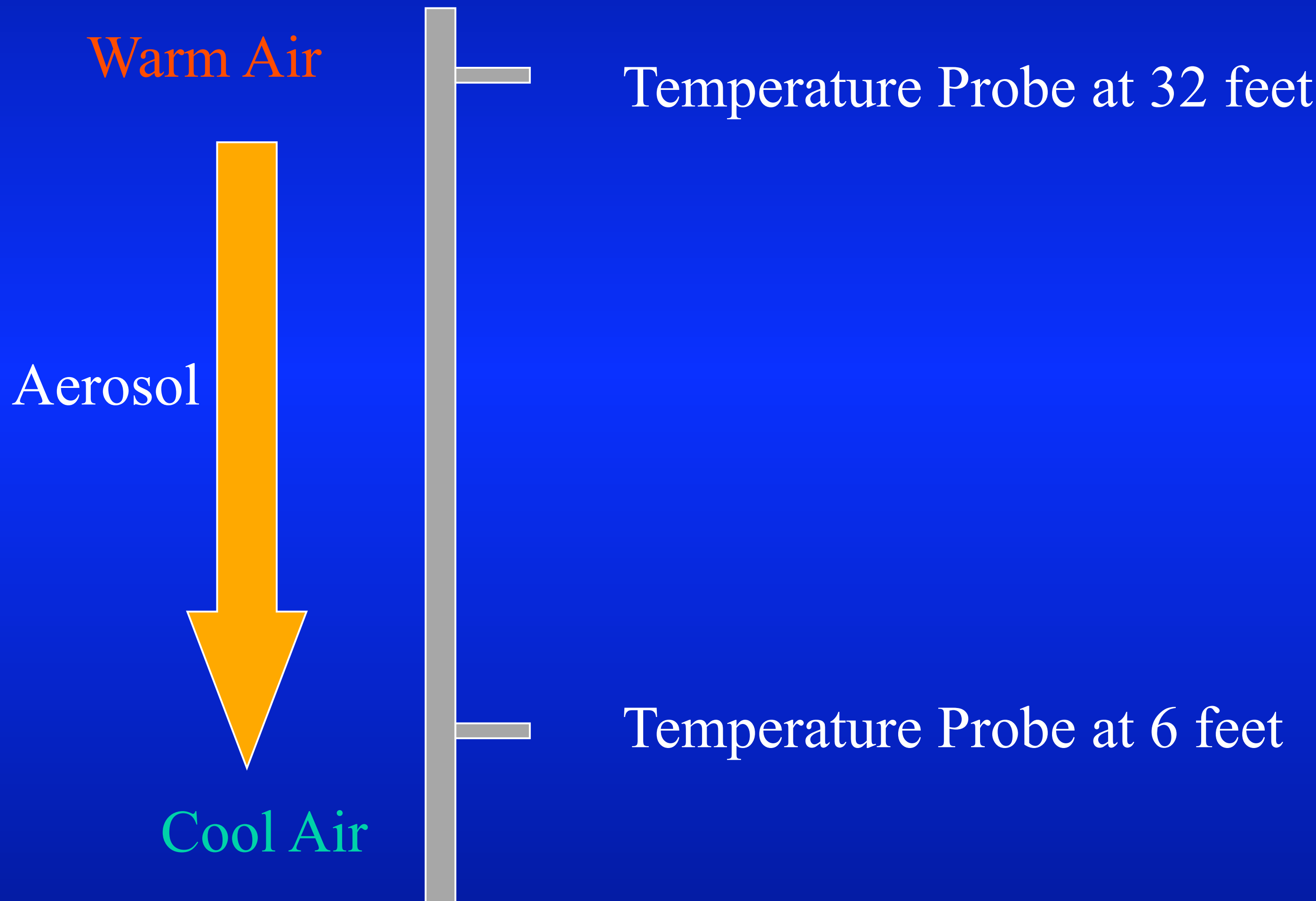
Weather Has a LOT to Do With Performance !!!!

# The Weather

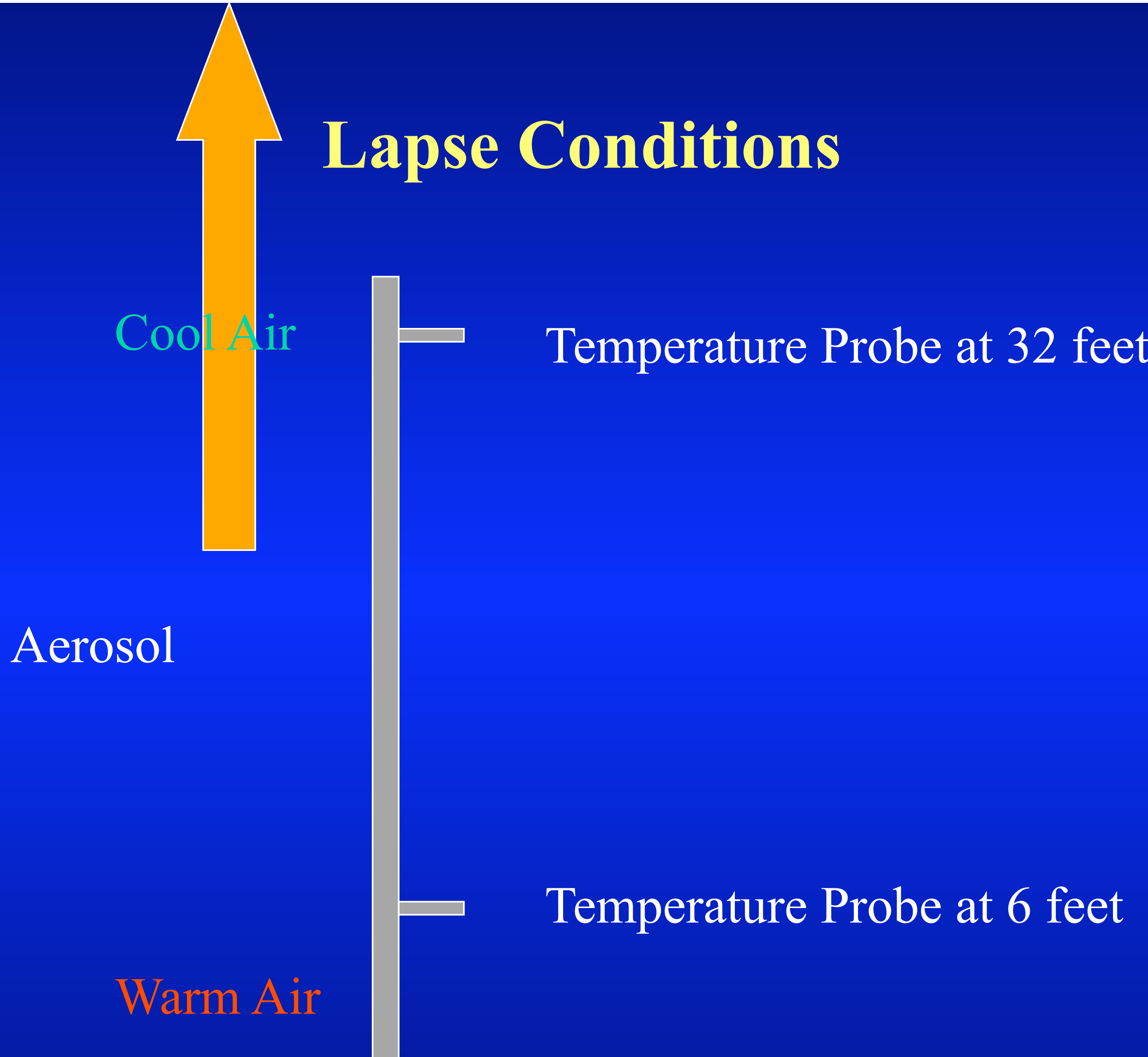
What type of weather do we want?

**An inversion with low wind speed!**

# Inversion Conditions



# Lapse Conditions



# Adulticiding: Factors to Consider

Timing

- Peak Activity Period of Mosquitoes (consider Ae. ab.)
- Consider Thermal Updrafts

Environmental Factors

- Rain/Wind are limiting factors
- Barriers to treatment

Areas/Maps/Record Keeping

# Evaluation

- Outcome of the Application
- Efficacy of the Material

- Did the Material get there?
- Did the Material kill the bugs?

# Questions?

# Adulticiding: Why is it Necessary?

- Part of an IPM Approach
- Complements Source Reduction and Larviciding
- Large Scale Larviciding May Not Always be Possible
- Presence of Disease and/or Vectors

# Goal: Amount per Given Area