Crop Areas and Rows

Crop #	Row #	AREAS (Start -- End)			
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-

Auto Time Programming

	Z #1 (Begin -- End)	Interval	Z #2 (Begin -- End)	Interval	Z #3 (Begin -- End)	Interval	Z #4 (Begin -- End)
Crop 1	-		-		-		-
Crop 2	-		-		-		-
Crop 3	-		-		-		-
Crop 4	-		-		-		-
Crop 5	-		-		-		-
Crop 6	-		-		-		-
Crop 7	-		-		-		-
Crop 8	-		-		-		-
Crop 9	-		-		-		-
Crop 10	-		-		-		-
Crop 11	-		-		-		-
Crop 12	-		-		-		-
Crop 13	-		-		-		-
Crop 14	-		-		-		-
Crop 15	-		-		-		-
Crop 16	-		-		-		-

Auto Time Programming

Interval

Passes and Waterings

Crop Number:	1	2	3	4	5	6	7	8
Number of Areas:								
Speed:								
Passes:								
Water / Mist / Both / Light:								
Step Distance (inches):								
Water Time (seconds):								

Crop Number:	9	10	11	12	13	14	15	16
Number of Areas:								
Speed:								
Passes:								
Water / Mist / Both / Light:								
Step Distance (inches):								
Water Time (seconds):								

Boom Set-Up Sheet

#2 - Boom Set-Up	
Bay Length:	
Home:	
Away:	
Parking Position:	
Go To Speed:	

Rows Under Boom -

Row 1 Mist / Water:	
Solenoids under Row 1:	
Row 2 Mist / Water:	
Solenoids under Row 2:	
Row 3 Mist / Water:	
Solenoids under Row 3:	
Row 4 Mist / Water:	
Solenoids under Row 4:	

#3 - System	
Pass Code:	
To Reset Crops:	*#3 = Set Up; #5 = Initailize; #1 = Reset Crops*

#4 - Motor	
Acceleration:	
Idler Wheel Diameter:	
Timeout:	

Crop Areas and Rows

Crop #	Row #	AREAS (Start -- End)			
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-

Auto Time Programming

	S #1 (Begin -- End)	Interval/Repeat	S #2 (Begin -- End)	Interval/Repeat	S #3 (Begin -- End)	Interval/Repeat
Crop 1	-		-		-	
Crop 2	-		-		-	
Crop 3	-		-		-	
Crop 4	-		-		-	
Crop 5	-		-		-	
Crop 6	-		-		-	
Crop 7	-		-		-	
Crop 8	-		-		-	
Crop 9	-		-		-	
Crop 10	-		-		-	
Crop 11	-		-		-	
Crop 12	-		-		-	
Crop 13	-		-		-	
Crop 14	-		-		-	
Crop 15	-		-		-	
Crop 16	-		-		-	

Passes and Waterings

Crop Number:	1	2	3	4	5	6	7	8
Number of Areas:								
Speed:								
Step Distance (inches):								
Water Time (seconds):								
Passes:								
Remote (yes/no):								
Start from Home (yes/no):								
Solenoids / Pass:								

Crop Number:	9	10	11	12	13	14	15	16
Number of Areas:								
Speed:								
Step Distance (inches):								
Water Time (seconds):								
Passes:								
Remote (yes/no):								
Start from Home (yes/no):								
Solenoids / Pass:								

Boom Set-Up Sheet

#2 - Boom Set-Up	
Bay Length:	
Home:	
Away:	
Parking Position:	
Go To Speed:	

Rows Under Boom -

Row 1 Mist / Water:	
Solenoids under Row 1:	
Row 2 Mist / Water:	
Solenoids under Row 2:	
Row 3 Mist / Water:	
Solenoids under Row 3:	
Row 4 Mist / Water:	
Solenoids under Row 4:	

#3 - System	
Pass Code:	
To Reset Crops:	*#3 = Set Up; #5 = Initailize; #1 = Reset Crops*

#4 - Motor	
Acceleration:	

Deceleration Factor -

0 - 25 fpm:	
25 - 50 fpm:	
50 - 100 fpm:	
100 to 150 fpm:	
Timeout:	

Hydrolysis - Are We Doing Something About It?

Some time ago, an interiorscape contractor lost an important client because he did not know about hydrolysis and how to prevent it. It seems that the client's building had palms in the atrium which were infested with mites. The population got so out of control that the cobwebs were everywhere and, despite intensive spraying with everything in his arsenal, the contractor could not control the mites.

The culprit: **Hydrolysis**
The solution: the building's owner hired another interiorscape contractor that successfully controlled and eradicated the mite infestation.
The means: knowledge of hydrolysis, its effects on pesticides, and its prevention.
Hydrolysis is the breakdown of the active ingredients in carbamate and organophosphate pesticides caused by high alkalinity.
****** In spray water, high alkalinity can be pH levels over 7.5******

The breakdown progresses virtually geometrically as the pH levels go up. And, in the case of the palms in the atrium, the contractor was filling the sprayers in the bathrooms of the building using city water that had a pH of 8.5! What this means is, that by the time the applicator filled the sprayer, mixed in the miticide and finally got out to the atrium, the high pH in the water had broken down the active ingredient in the miticide and the spray on the palms had the same effect as: **Milk!**
It was a hard lesson to learn and maybe one we should review periodically, as we all tend to overlook bits of information that could be instrumental to the success of our operations, in this case, spraying pesticides for their true effect: **Killing Bugs!**

Controlling Hydrolysis is very simple. It just means knowing the pH level of the water you are using to fill your tanks and correcting it to a reasonable acid level, between 6.0 and 6.5. This is a safe range where most pesticides will work well and maintain their potency.
Adjust the pH level in your water by adding acid to lower the pH to the desired range. This can be phosphoric acid, sulfuric acid and/or some of the various "buffering" agents such as surfactants, emulsifiers, conditioners, spreaders, and stickers that are available through your friendly chemical supplier. A general rule of thumb is that *6 oz of 80% Phos Acid will lower the pH from 7.2 to 6.5 in 100 gallons of water*. However, mineral compositions of water vary with location, so your best bet is to test it yourself using litmus paper, or a pH tester. If you still need more specific information on particular products, ask your extension agent or chemical salesperson.

Nozzles Tips - Critical to Effective Spraying and Coverage

Good quality accurate spray tips are critical to the success of the operation of the Boom Sprayer and yet they are rarely checked for wear or visible damage, which often results in ineffective application, coverage, crop damage and loss of yield. We tend to be frugal up front by saving as much as possible on the spray tips, when really we should be thinking of investing in the assurance that they will perform properly and give us better results in the long run. Installing nozzles that will resist wear and calibrating them on a regular basis will save money in chemicals, alone. A 500 acre farm using nozzles that have a wear of 10% will add over $4500.00 to its chemical costs. And then you add the cost of the inefficient applications, crop damage and low yields. Just imagine what you have been pouring down the drain, so to speak! Tips should be correctly maintained, with regular checks for visible damage and inaccurate flow. You should replace your tips when the original flow rate goes over 10%.

How Do You Calculate Wear? The nozzle industry works on a parameter that indicates that a brass nozzle at 200psi will achieve a 10% wear in 10 hours. Just think how long you've been running your nozzles out there without even thinking that they may be wearing. Other materials are more expensive than the standard brass tips, and the wear resistance increases with the material hardness and, of course the cost. However, a few years ago the Europeans made a breakthrough in producing nozzles in Polyacetal, an "engineering plastic" material which, with the help of the latest computer technology, can be precision molded to extremely fine tolerances. Also, where other plastics such as nylon readily absorb water and swell up in the process, Polyacetal is particularly stable. Perhaps the most striking quality of Polyacetal tips is their remarkable resistance to wear - superior even to stainless steel.

Relative Nozzle Tip Wear Life

Material	***Wear Factor***
Brass & Aluminum	**1**
Stainless Steel	**2 to 3**
Hardened Stainless Steel	**10 to 15**
Ceramic	**Lifetime**
Carbides (Tungsten, Chrome)	**Lifetime**

The above shows the wear factors of the common spay tip materials in the low to medium price range. Ceramic and Tungsten Carbide spray tips, which have a practically negligible wear factor, are three to five times the cost of spray tips made out of the materials shown on the chart. Polyacetal tips are available in most popular configurations such as fan, disc/core, hollow cone and deflected fan tips.

Choosing the Right Spray Tips

Droplet size and spray quality are affected by various factors, including the properties of the liquid, specific gravity, viscosity and surface tension. The applicator can significantly influence the quality of the spray pattern by the choice of:

- ***Nozzle Type*** - A hollow cone tip will generally produce a finer spray than a fan tip of the same output, pressure and spray angle.
- ***Nozzle Size*** - A small output spray tip will generally produce a finer spray than a large one - given the same nozzle type, spray angle and pressure.
- ***Operating Pressure*** - The spray from any tip will become finer as the pressure is increased.
- ***Fan Spray Angle*** - A 110 degree fan spray tip will give a finer spray than its 80 degree counterpart, where output and pressure are the same.

Choosing the Correct Application Rate

The spray volume or application rate is normally recommended on the chemical label and expressed in gallons per acre or liters per hectare, with upper and lower limits. Select the application rate on the basis of:

- Chemical label information or consultant data
- Special crop requirements - penetrating a dense canopy may require the higher end of the volume range
- The limits of the sprayer pump capacity at the PTO speeds to be used. Always allow plenty of spare capacity for agitation - especially with wettable powders
- If in doubt, use the high volume rate, ensuring that the spray quality is consistent with what has been recommended

Spraying in Wind

Windspeeds are critical when spraying. Spraying when it is too windy leads to poor application patterns as well as drift. Great care must be taken when assessing wind speeds before and during spraying.

Following are some guidelines for observing the effects of the wind. Generally, wind speeds of 2 to 5 mph are ideal for spraying.

- Less than 1 mph - calm - smoke rises vertically
- 1 to 2 mph - Light air - smoke drifts off
- 2 to 4 mph - Light Breeze - leaves rustle, wind felt on face
- 4 to 6 mph - Gentle Breezes - leaves and twigs in constant motion
- 6 to 9 mph - Moderate - small branches move, raises dust or loose paper

Setting the Boom Height

Each tip on a spray boom must not only deliver the correct flow rate, but must distribute the spray evenly across the boom width. When using flat fan spray tips, the spray from each tip should overlap the neighbor's by at least 50%. This is a function of tip height and spray angle.

When using hollow or full cone pattern tips, the boom height should be such that the edge of each pattern touches the edge of the neighbor's pattern at the target height.

To test the even pattern of your spray, regardless of the nozzle type, fill the sprayer with clean water and spray an area of dry concrete. If the surface dries leaving "wet streaks", the application is incorrect and the boom height should be adjusted so that the surface dries out evenly, assuming that the nozzle tips are in good order and are spraying correctly.

---Cherry Creek Systems Chemical Application 'Cheat Sheet'---

-This publication contains chemical application *recommendations* that are subject to change at any time. These *recommendations* are provided only as a guide; specific restrictions will vary in each state and other countries. It is always the chemical applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. If any information in the following *recommendations* disagrees with the label, the label recommendation must be followed. NO endorsement is intended for products mentioned, nor criticism for products not mentioned.

-Some of the information included in this publication is taken from: "Tips on Managing Floriculture Crop Problems" published by OFA Services. This book will go more into detail about these chemicals and their uses, as well as further instructions on application.

Please contact our Sales / Customer Service Department with any questions, *or* if you need any further guidance on applying chemicals through the Booms or ECHO's:

(877) 558-3246 - Toll Free
(719) 380-8373 - Office
(719) 380-8695 - Fax
info@cherrycreeksystems.com

CHERRY CREEK SYSTEMS

Greenhouse Equipment Specialists

---Cherry Creek Systems Chemical Application 'Cheat Sheet'---

Revised 1/07

Chemical Name	Active Ingredient	Chemical / 100 gal.	Controlled Pest(s)	Spray/ Sp-rench/ Drench	Speed	# of Passes	TeeJet
Avid 0.15EC	abamectin	4 to 8oz.	Mites / Thrip	Spray leaf surface	75	1	Yellow .02
Conserve SC	spinosad	8 to 22oz.	Thrip / Lepidoptera	Spray till run-off	75	2	Yellow .02
Marathon II	imidacloprid	1.7 oz.	Aphids / Whitefly	Drench media	10	s/s/w	'lock-line'
Flagship 25WG	thiamethoxam	2 to 4oz.	Aphids / Whitefly	Drench media	10	s/s/w	'lock-line'
Distance	pyriproxyfen	6 to 12oz.	Shorefly/Fungus gnat	Sp-rench media surface	50	2	*White* ***.08***
Gnatrol	bacillus thuringiensis	16 to 64oz.	Fungus Gnat	Sp-rench media surface	50	2	*White* ***.08***
Endeavor	pymetrozine	2.5 to 5oz.	Aphids	Spray leaf surface	75	1	Yellow .02
Orthene 97	acephate	1/2 lb.	Aphids / Mealybugs	Spray leaf surface	75	1	Yellow .02
Tame 2.4EC	fenpropathrin	10 oz. + Orthene	Aphids / Mealybugs	Spray leaf surface	75	1	Yellow .02
Talstar GH	bifenthrin	8 to 40oz.	Aphids / Whitefly	Spray leaf surface	75	1	Yellow .02
Thiodan 3EC	endosulfan	2/3 qt.	Aphids / Whitefly	Spray leaf surface	75	1	Yellow .02
Enstar II	s-kinoprene	5 to 10oz.	*multiple applications*	Spray till run-off	75	2	Yellow .02
Mavrik Aquaflow	fluvalinate	4 to 10oz.	*multiple applications*	Spray till run-off	75	2	Yellow .02
Ornazin 3%	azadirachtin	8oz.	Whitefly / Thrip	Spray leaf surface	75	1	Yellow .02
TetraSan 5WDG	etoxazole	8 to 16oz.	Mites (ovacide)	Spray leaf surface	75	1	Yellow .02
Sanmite 75WP	pyridabem	2 to 4 oz.	Mites	Spray leaf surface	75	1	Yellow .02
Pylon	chlorfenapyr	2.6 to 5.2oz.	Mites / Mealybugs	Spray leaf surface	75	1	Yellow .02
Measurol 75WP	methiocarb	4 lbs	Thrip / Slugs	Spray till run-off	75	2	Yellow .02
Pedestal 10SC	novaluron	6 to 8oz.+ 2L. Mt. Dew	Thrip / Lepidoptera	Spray till run-off	75	2	Yellow .02

*****Always flush system after applying chemicals and before resuming regular irrigation schedule*****

Keep in mind that some WP's, WSP's, and Granular Chemicals need constant agitation during the application process.
When using 'mist' bar on Booms for ***spraying***, adjust the bar so the bodies are at 45 degree angle toward the floor/ bench.
When using 'water' bar on Booms for ***sp-renching***, adjust the bar so the bodies are pointing straight at the floor/ bench.
When using 'lock-tube' assembly on Booms for ***drenching*** make sure all of the assembly's are correctly calibrated to assure even distribution.
Calibration of **all** TeeJet tips and assemblies is recommended at **(1)** one year intervals. TeeJet Calibration kits are available through Cherry Creek Systems
Suggestions refer to injecting chemicals through a portable injector. The solution is run into the Boom and ECHO irrigation systems @ a rate of **1:100.**
The results vary according to the amount of active ingredient and the amount of total solution applied to the plant/soil surface. Refer to label for PartsPerMillion.

* These are strictly recommendations. These rates are in accordance to the label provided by the Chemical company. We do not suggest changing any label rates for any reason. Conditions vary, so always refer to label for favorable conditions for application. Refer to label for list of acceptable plants before application.

**** Cherry Creek Systems is not responsible for any misapplication, or plant loss due to misapplication. These are suggestions based on experience.**

INSECTICIDES For use with Cherry Creek Systems Booms and ECHO's

---Cherry Creek Systems Chemical Application 'Cheat Sheet'---

Revised 1/07

Chemical Name	Active Ingredient	Chemical / 100 gal.	Controlled Pest(s)	Spray/ Sp-rench/ Drench	Speed	# of Passes	TeeJet
ZeroTol	hydrogen dioxide	.03 to 1oz.	*multiple applications*	Spray *or* Sp-rench *or* Drench	-	*varies/app.*	*varies/app.*
PlantShield	*Trichoderma*	3 to 5oz.	*multiple applications*	Drench *or* Sp-rench media	10	s/s/w	'lock-line'
Companion .03%	*Bacillus*	16oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Spectro 90WDG	clorothalonil + thiophanate-methyl	1 to 2 lbs	foliar disease's	Spray leaf surface	50	1	Yellow .02
Zyban 75WP	mancozeb + thiophanate-methyl	1.5 lbs	foliar disease's	Spray leaf surface	50	1	Yellow .02
Dithane T/O	mancozeb	1.5 lbs	foliar disease's	Spray leaf surface	50	1	Yellow .02
Heritage 50WP	azoxystrobin	4 to 8oz.	foliar disease's	Spray leaf surface	50	1	Yellow .02
Decree 50WP	fenhexamid	1 to 2 lbs	*Botrytis*	Spray till run-off	50	2	*White* ***.08***
Banrot 40WP	ethazol + thiophanate-methyl	4 to 12oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Terraclor 75WP	quintozene	4 to 8oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Medallion 50WP	fludioxonil	2 to 4oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Subdue Maxx	mefenoxam	0.13 to 2oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Cleary's 3336 50WP	thiophanate-methyl	8 to 16oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Banol 66.5EC	propamocarb	10 to 33oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Truban 25EC	etridiazole	3 to 10oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Aliette 80WDG	fosetyl-Al	0.4 to 0.8oz.	root and crown rots	Drench media	10	s/s/w	'lock-line'
Piperon 82.4EC	piperalin	4 to 8oz.	foliar disease's	Spray leaf surface	50	1	Yellow .02
Systhane WSP	myclobutanil	4oz.	foliar disease's	Spray leaf surface	50	1	Yellow .02
Strike 50DF	triadimefon	2 to 4oz.	foliar disease's	Spray leaf surface	50	1	Yellow .02

*****Always flush system after applying chemicals and before resuming regular irrigation schedule*****

CHERRY CREEK SYSTEMS
Greenhouse Equipment Specialists

Keep in mind that some WP's, WSP's, and Granular Chemicals need constant agitation during the application process.

When using 'mist' bar on Booms for ***spraying***, adjust the bar so the bodies are at 45 degree angle toward the floor/ bench.

When using 'water' bar on Booms for ***sp-renching***, adjust the bar so the bodies are pointing straight at the floor/ bench.

When using 'lock-tube' assembly on Booms for ***drenching*** make sure all of the assembly's are correctly calibrated to assure even distribution.

Calibration of **all** TeeJet tips and assemblies is recommended at **(1)** one year intervals. TeeJet Calibration kits are available through Cherry Creek Systems.

Suggestions refer to injecting chemicals through a portable injector. The solution is run into the Boom and ECHO irrigation systems @ a rate of **1:100.**

The results vary according to the amount of active ingredient and the amount of total solution applied to the plant/soil surface. Refer to label for PartsPerMillion.

***** These are strictly recommendations. These rates are in accordance to the label provided by the Chemical company. We do not suggest changing any label rates for any reason. Conditions vary, so always refer to label for favorable conditions for application. Refer to label for list of acceptable plants before application.

**** Cherry Creek Systems is not responsible for any misapplication, or plant loss due to misapplication. These are suggestions based on experience.**

FUNGICIDES

For use with Cherry Creek Systems Booms and ECHO's

---Cherry Creek Systems Chemical Application 'Cheat Sheet'---

Revised 1/07

Chemical Name	Active Ingredient	P.P.M	/ 100 gal.	Surfactant / 100gal.	Spray/ Sp-rench/ Drench	Speed	# of Passes	TeeJet
A - Rest	ancymidol	2	100oz.	Yes, AquaGro, 1/2oz.	Drench media	10	s/s/w *or* 2	'lock-line'
		10	480oz.	None	Sp-rench top of media	50	2	*White* ***.08***
		25	1210oz.	None	Spray leaf surface	100	1	Yellow .02
Bonzi, Piccolo	paclobutrazol	1	3.2oz.	Yes, AquaGro, 1/2oz.	Drench media	10	s/s/w *or* 2	'lock-line'
		10	16oz.	None	Sp-rench top of media	50	2	*White* ***.08***
		25	80oz.	None	Spray leaf surface	100	1	Yellow .02
Cycocel	chlormequat	800	87oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
		1250	136oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
		2000	217oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
B - Nine	daminozide	1000	16oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
		2500	40oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
		3750	60oz.	Yes, Capsil, 3.5oz.	Spray leaf / stem surface	75	1	Yellow .02
Sumagic	uniconizole	1	26oz.	Yes, AquaGro, 1/2oz.	Drench media	10	s/s/w *or* 2	'lock-line'
		10	260oz.	Yes, Capsil, 1oz.	Sp-rench top of media	50	2	*White* ***.08***
		25	640oz.	Yes, Capsil, 2oz.	Spray leaf / stem surface	100	1	Yellow .02
Florel 'Pistell'	ethephon	300	100oz.	Yes, Capsil, 2oz.	Spray leaf / stem surface	75	1	Yellow .02
		750	240oz.	Yes, Capsil, 2oz.	Spray leaf / stem surface	75	1	Yellow .02
		1000	320oz.	Yes, Capsil, 2oz.	Spray leaf / stem surface	75	1	Yellow .02
Facination	BA / GA 4 +7	10 // 10	7oz.	None	Spray **lower** leaves / stem	100	1	'lock-line'

*****Always flush system after applying chemicals and before resuming regular irrigation schedule*****

Keep in mind that some WP's, WSP's, and Granular Chemicals need constant agitation during the application process.
When using 'mist' bar on Booms for ***spraying***, adjust the bar so the bodies are at 45 degree angle toward the floor/ bench.
When using 'water' bar on Booms for ***sp-renching***, adjust the bar so the bodies are pointing straight at the floor/ bench.
When using 'lock-tube' assembly on Booms for ***drenching*** make sure all of the assembly's are correctly calibrated to assure even distribution.
Calibration of **all** TeeJet tips and assemblies is recommended at **(1)** one year intervals. TeeJet Calibration kits are available through Cherry Creek Systems
Suggestions refer to injecting chemicals through a portable injector. The solution is run into the Boom and ECHO irrigation systems @ a rate of **1:100.**
The results vary according to the amount of active ingredient and the amount of total solution applied to the plant/soil surface. Refer to label for PartsPerMillion.

CHERRY CREEK SYSTEMS
Greenhouse Equipment Specialists

* These are strictly recommendations. These rates are in accordance to the label provided by the Chemical company. We do not suggest changing any label rates for any reason. Conditions vary, so always refer to label for favorable conditions for application. Refer to label for list of acceptable plants before application.

**** Cherry Creek Systems is not responsible for any misapplication, or plant loss due to misapplication. These are suggestions based on experience.**

P.G.R.'S For use with Cherry Creek Systems Booms and ECHO's