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Automatic Section Control (ASC) Technology for Agricultural Sprayers

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Automatic section control (ASC) or auto-swath technology has been readily adopted on agricultural sprayers over the past few years. Farmers or others implementing this technology have experienced immediate benefits on input savings and a reduction in the occurrence of overlap within fields. Simply, the technology turns sections or nozzles OFF in areas that have been previously covered or ON and OFF at headland turns, point rows, terraces, waterways and other areas marked for no-application of pesticides or nutrient. ASC technology utilizes a GPS/GNSS-based guidance system for location of the predefined no-application areas as well as keeping the implement from overlapping adjacent swaths. Currently, equipment manufacturers and third-party companies are offering systems that control boom-sections (Fig. 1a) or even individual nozzles (Fig. 1b) on agricultural sprayers with the number of control channels determining the control resolution. However, the performance of this technology is partially associated with the GPS correction service used. Today, most sprayer manufacturers provide this technology as an option on new sprayers. Nonetheless, some older sprayers can be retrofitted with ASC but consult the manufacturer concerning compatibility with your equipment.

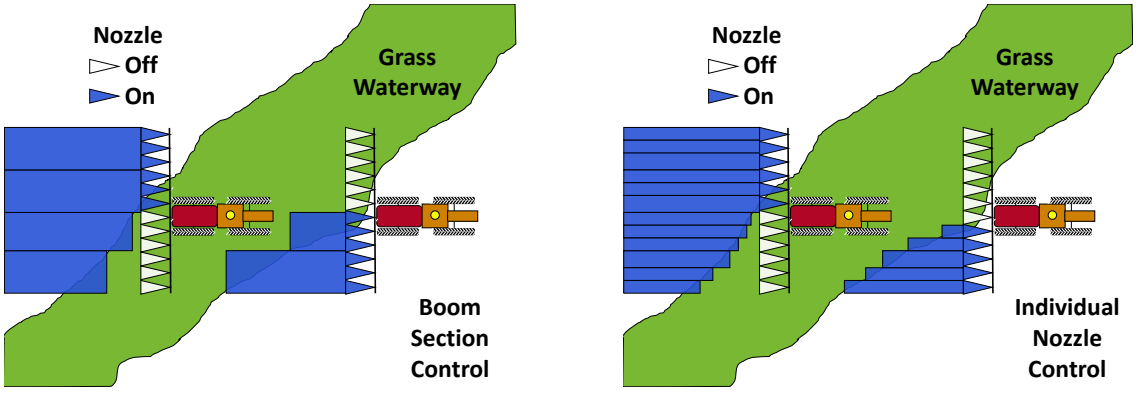


Figure 1. Example of a sprayer equipped with GPS/GNSS-based automatic boom-section control (a) and a sprayer equipped with individual nozzle control (b), both traversing a grassed waterway. In this example, the technology provides the benefit of treating the cropland while preserving the grassed waterway.

Benefits

A study at Auburn University indicated **input savings between 2% and 12%** with an approximate **average of 4.3%** within a field using ASC technology. These savings alone showed that the **technology would pay for itself within 2 years** (several cases <1 year) for most Alabama farm operations. However, these **savings are dependent upon field shape and size** with highest benefits occurring in small, irregular shaped fields or fields containing conservation management structures such as grassed waterways.

***Benefits* of this technology include**:

1. Improved overall sprayer accuracy
2. Reduced application overlap thereby reducing input costs
3. Improved environmental stewardship
4. Reduced crop damage from over-application of pesticides
5. Improved application efficiency (reduce in-field time)
6. Optimized operator efficacy and reduced fatigue
7. As applied maps and records for future management decision making

If you consider that a guidance system is typically used in conjunction with ASC technology, the savings will be more than those reported above for just ASC (can be in the 20% to 30% range). Savings are largely dependent upon the GPS/GNSS receiver accuracy. A Real-Time Kinematic (RTK; sub-inch accuracy) GPS/GNSS receiver can provide highest input savings for these technologies. However, increasing the level of correction service used can also increase component costs.

System Components

The cost for this technology generally starts around $2000 but depends upon existing technology and equipment already being used on your farm. At minimum, you must have a:

1. **GPS/GNSS receiver** – For best results and highest accuracy during spraying operations, RTK or a decimeter level (OmniStar HP or John Deere SF2) correction service is recommended. However, other correction services (e.g. WAAS, SF1, etc.) can provide beneficial results.

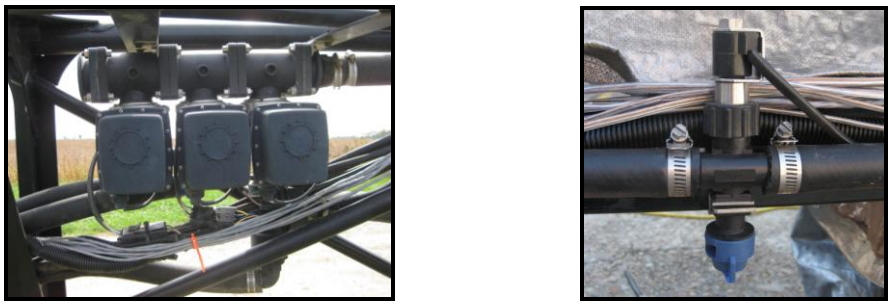
(a) (b)

Figure 2. Image of John Deere StarFire (a) and Trimble (b) GPS receivers.

2. **Spray Controller** with software capable of automatic section control (Figure 3). Please note the number of control channels will limit the number of sections or individual nozzles that can be independently controlled.

Figure 3. Screen capture from a display showing a coverage map and indicating when sections are turned ON and OFF (blue squares) when using ASC technology on a sprayer. In this example, the sprayer was setup for 5-section control.

3. **Section Control Mechanism -** Compatible boom valves (Fig. 4a) or nozzle solenoids (Fig. 4b).



(a) (b)

Figure 4. Boom-valves which provide auto-boom capabilities (a) or a solenoid mounted on a nozzle body that offers individual nozzle control or auto-nozzle capabilities (b).

4. Necessary wiring harness, cabling, electronic control unit (ECU), and possibly other small components or supplies.

Other components can include a flow meter or other feedback sensors to maintain the desired application rate when turning nozzles or sections ON/OFF. Please consult manufacturers for the necessary components to be used on your specific sprayer.

Calibration and Other Operating Considerations

1. Calibration: To maximize benefits from ASC sprayers, calibration is critical. Beyond the routine calibration of the sprayer and controller, the **look-ahead time needs to be set correctly** to ensure sections are being turned ON or OFF at the correct location. Incorrectly setting this feature may result in skips (turning OFF too quickly) or excessive overlap (staying ON too long) at locations such as previously sprayed headlands. It may be necessary to consult the operator's manual or a representative from the manufacturer to ensure the proper settings to accomplish accurate field results.
2. Firmware Updates: Ensure your controller and GPS/GNSS receiver are kept up-to-date with the latest firmware/software version. These updates are important to guarantee the technology maximizes full benefits. Manufacturers provide firmware updates periodically so either check their website or call your local dealer.
3. Visual Inspection: Routinely check to make sure that all cables and wires are secured and that the boom valves or nozzle solenoids are in good working order.
4. Clearance Issues: With someone assisting, unfold the spray boom to make sure all cables and wires are out of moving components or are not over stretched.
5. Proper Operation: Power up your system and make sure everything is operating correctly. Manually switch ON and OFF sections and check that the controller is receiving a GPS/GNSS signal.
6. Connections: Periodically check all electrical connections during filling or normal maintenance procedures. This routine inspection can help identify potential issues before they occur.

Please consult the operator's manual for the sprayer, controller, ASC technology, etc. to make sure everything is setup correctly and working as expected.

Available Systems and Technology

A *partial* list of companies providing ASC technology (last updated March 2011).

Company	System Name	No. of Section Controls	Website
Topcon	X20 Auto-Section Control	Up to 30	1
	X30 Auto-Section Control	Up to 32	
	Systems 110, 150, 200 and 250		
John Deere	Swath Control Pro™	Up to 12	2
	Relevant Controllers		
	GreenStar™ 2 & 3 (GS2 & GS3)		
	SprayStar™		
Raven	AccuBoom (CAN)	Up to 10	3
	AccuBoom (Parallel)	Up to 7	
	SmartBoom	Up to 10	
	Relevant Controllers		
	SCS 330	Up to 3	
	SCS 400 Series	3, 6, or 7	
	SCS 600 Series	Up to 7	
	SCS 4000 Series	3, 6, 7 or 10	
	Viper Pro		
	Envizio Pro & Envizio Pro II		
	Cruizer & Cruizer II		
TeeJet / Mid-Tech	Swath Manager	Up to 5	4
	Boom Pilot™	Up to 15	
	Centerline® 230BP	Up to 15	
	Relevant Controllers		
	Legacy 6000		
	Matrix (570G and 840G)		
	ARC-TASC Series Rate Controllers		
	844 and 854 Rate Controllers		
Trimble	AgGPS® EZ-Boom™	Up to 10	5
	Tru Application Control ™ (TAC)	Up to 24	
	Field-IQ	Up to 48	
	Tru Count LiquiBlock Valves	Up to 48	
	Relevant Controllers		
	AgGPS FmX Integrated Display		
	CFX-750 Display		
	EZ-Guide 500		
AgLeader Technology	AutoSwath™	Up to 10	6
	Relevant Controllers		
	Insight with DirectCommand		
	Integra with DirectCommand		
	Edge with DirectCommand		
Farmscan	Farmlap ABS 5210	Up to 10	7
	Farmlap Spray Control with Auto Boom Switching	Up to 14	
	Canlink 3500 Spray Guidance with TWIN Spray Line Control	5, 7, or 9	
Leica	AutoSPRAY AS7500	Up to 30	8

Nozzle Solenoids for Auto-Nozzle Capabilities

Company	System Name	Website
TeeJet	DirectoValve® Control Valves	4
	e-ChemSaver™ Solenoid Operated Electric Shut-Off Valve	
Capstan	PWM Individual Nozzle Solenoids	9
Harrison Ag Technologies	Smart Nozzle	10

Related Websites

1 www.topconpositioning.com	4 www.mid-tech.com	7 www.farmscan.net	10 www.H-AgTec.com
2 www.deere.com	5 www.trimble.com	8 http://agriculture.leica-geosystems.com/en/index.htm	
3 www.ravenprecision.com	6 www.agleader.com	9 www.capstanag.com	

Disclaimer

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