FAA Approved

For Aircraft Defined by SA01995WI AML

CapstanAG™

Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement

SwathPRO™

For AirTractor

Model No. _____

Serial No. _____

Registration No. _____

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the SwathPRO™ system has been installed in accordance with STC SA01995WI.

The information contained in this supplement supersedes or adds to the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only as set forth herein. For limitations, procedures, performance, and loading information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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11/15/2024

Approved Date

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Change Log

Revision	FAA Approval	Description
A	Kent S. Lund, Manager, Flight Test & Human Factors Branch, AIR-710 Federal Aviation Administration 08/18/22	Initial Release
B	Scott West Lead ODA Administrator Aeronautix ODA-834865-CE 11/15/2024	SwathPRO Main “circuit breaker” terminology revised to “toggle switch’ throughout. Verbiage for 7A Circuit Breaker removed throughout Graphic color “gray” changed to “white” throughout Acronym List revised Electrical Fire While Flying text revised 50 Amp Circuit Breaker revised to 60 Amp Electrical System text revised CapView Turns Off While Flying text revised After Landing text revised Upload a Profile to the CapView text and figure revised Figure 12 callouts revised Wind Sensor text revised Equipment List revised System Summary figure removed Main Operation Screen text revised Manual Mode text revised System Setup Menu Descriptions text edited Auto Mode and Manual mode Advanced Settings tables combined, text edited SwathPRO Main Switch added to Table 4, related figures added/revised Spray Handle Microswitch heading added and description revised SWATHPRO MAIN Circuit Breaker figure and text revised, moved ahead of Spray Handle Microswitch

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Contents

Section 1: General

Topics:

This AFM Supplement

The information in this supplement is FAA approved material and must be attached to the POH and FAA Approved AFM when the aircraft has been modified by the installation of the SwathPRO™ system, in accordance with applicable approved data.

The information in this supplement supersedes or adds to the basic POH/AFM, only as detailed in this manual. Users of this manual are advised to always refer to this supplement for possibly superseding information and placarding applicable to the operation of the aircraft.

Modification for SwathPRO™

The SwathPRO™ system removes and replaces the factory spray booms.

The system added electronically controlled spray valves to control spray patterns.

The CapView display in the aircraft cockpit lets the pilot upload custom spray patterns and save preset pattern profiles for selection in-flight.

Spray on/off is controlled by the use of the existing spray handle (with no changes) or rate controller, as applicable.

The SwathPRO™ system is compatible with aftermarket rate controllers and spray nozzles.

References

For additional information, refer to:

Table 1: Reference List

Title	Part Number	Description
Instructions for Continued Airworthiness for the SwathPRO™ System (ICA)	320700-005	Maintenance information for the system
SwathPRO™ Installation Guide	320700-007	System installation information
ProMaker User Guide	320700-002	Computer software manual to make profiles

Acronym List

Table 2: Acronym List

Acronym	Description
POH	Pilot's Operating Handbook
AFM	Airplane Flight Manual
ICA	Instructions for Continued Airworthiness
FAA	Federal Aviation Administration
VCM	Valve Control Module
VMD	Volume Median Diameter
DTM	Deutsch Mini
PWM	Pulse Width Modulation
LED	Light Emitting Diode
CAN	Controller Area Network
CB	Circuit Breaker
GND	Ground
SWPWR	Switched Power

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Section 2: Limitations

Topics:

All limitations specified in the POH and associated supplements remain unchanged when the SwathPRO™ system is installed, with the exceptions of the limitations listed below.

Airspeed Limitations

Table 3: Airspeed Limitations

Speed	Model	Serial Number	KCAS	KIAS	IAS (MPH)	Remarks
Maneuver (V_A)	AT-802	802-0001—802-0059	142	142	163	No full or abrupt control movements above this speed.
	AT-802	802-0064 & subsequent	140	140	161	
	AT-802A	802A-0003—802A-0058	142	137	158	
	AT-802A	802A-0060 & subsequent	140	137	156	

System and Equipment Limits

Auto Pilot

Simultaneous operation of the SwathPRO system and the aircraft autopilot is prohibited.

Electrical System

Simultaneous operation of the SwathPRO system and the aircraft landing lights is prohibited due to the factory 150 amp generator limitation. The pilot should monitor electrical loads during operation of the SwathPRO system to ensure electrical loads stay below 150 amps.

Placards

The following information on placards pertaining to flight and operating limitations must be displayed in full view of the pilot:

1. Air Tractor 802 Models; Serial Numbers: 802-0001 thru 802-0059
   - MANEUVERING SPEED 163 mph (142 kts) IAS WHEN SWATHPRO BOOMS INSTALLED
2. Air Tractor 802 Models; Serial Numbers: 802-0064 & subsequent
   - MANEUVERING SPEED 161 mph (142 kts) IAS WHEN SWATHPRO BOOMS INSTALLED
3. Air Tractor 802A Models; Serial Numbers: 802A-0003 thru 802A-0058
   - MANEUVERING SPEED 158 mph (142 kts) IAS WHEN SWATHPRO BOOMS INSTALLED
4. Air Tractor 802A Models; Serial Numbers: 802A-0060 & subsequent
   - MANEUVERING SPEED 156 mph (142 kts) IAS WHEN SWATHPRO BOOMS INSTALLED

Section 3: Emergency Procedures

Topics:

All emergency procedures specified in the POH and associated supplements remain unchanged when the SwathPRO™ system is installed, with the exceptions of the additional SwathPRO™ system procedures listed in this section.

Electrical Fire While Flying

If the CapView shuts down, and electrical smoke or fire is seen or smelled, the SwathPRO™ system may be the issue.

1. Toggle the switch labeled **SWATHPRO MAIN** to **OFF**.
2. Open all cockpit air vents to ventilate any smoke as necessary.
3. Land as soon as possible.

Section 3A: Abnormal Procedures

Topics:

All abnormal procedures specified in the POH and associated supplements remain unchanged when the SwathPRO™ system is installed, with the exceptions of the SwathPRO™ system procedures listed in this section.

Alarm

Figure 1: Alarm Button

If the alarm on the CapView sounds, press the **ALARM** button (Figure 1, Item 1) to silence the alarm. Information about the item that caused the alarm will show on the bottom of the CapView screen.

Note: It is the responsibility of the pilot to stop using the system if the system is not applying product or operating correctly.

Note: The LED (Figure 1, Item 2) will continue to blink. If the issue is not resolved after several minutes, the alarm will sound again.

The list on the following page details the steps that should be taken in the event any CapView alarm is set.

CapView Alarms

Coil Circuit Open

1. Determine if flight can be continued with number of functioning valves
2. Notify maintenance

Coil Circuit Short

1. Determine if flight can be continued with number of functioning valves
2. Notify maintenance

Key Fob Mode Active

1. System Setup ..... PRESS
2. Down Arrow ..... PRESS to reach **Nozzle Control (Key Fob)** line
3. Enter ..... PRESS (line will highlight red)
4. Down Arrow ..... PRESS until **12V Active** displays
5. Enter ..... PRESS (line will highlight yellow)
6. Escape ..... PRESS

Missing Hub

1. Capview POWER ..... OFF
2. SwathPRO Main Toggle Switch ..... Cycle OFF-ON
3. Capview POWER ..... ON
4. If error is still active, notify maintenance

Missing VCM

1. Capview POWER ..... OFF
2. SwathPRO Main Toggle Switch ..... Cycle OFF-ON
3. Capview POWER ..... ON
4. If error is still active, notify maintenance

No GPS Signal

1. System Setup ..... PRESS
2. Down Arrow ..... PRESS to reach **Rate Sync Mode** line
3. Enter ..... PRESS (line will highlight red)
4. Down Arrow ..... PRESS until **Disable** displays
5. Enter ..... PRESS (line will highlight yellow)
6. Escape ..... PRESS
7. Determine if flight can be continued
8. Notify maintenance

System Pressure Sensor

1. Enter ..... PRESS (Circle around pressure readout will turn white)
2. Determine if flight can be continued spraying in Manual Mode
3. Notify maintenance

Valves Not Found

1. Determine if flight can be continued with number of functioning valves
2. Notify maintenance

Valve Lodged

1. Determine if flight can be continued with number of functioning valves
2. Notify maintenance

Operate the SwathPRO Bypass Switch or Spray Without the Microswitch

If the microswitch stops working, use the switch labeled **SWATHPRO BYPASS** (Figure 15, Item 1) to turn the booms on and off manually.

1. If the microswitch is not operating correctly, move the **SWATHPRO BYPASS** switch to the **BYPASS** (on) position.
2. Turn on the CapView to have the valves pulse at the duty cycle of the loaded profile.
3. Move the **SWATHPRO BYPASS** switch to the normal (off) position to shut off the valves at the end of the field.

Forced Shutdown—Unresponsive CapView

If the CapView is unresponsive to button presses, do a forced shutdown of the CapView.

Figure 2: CapView Power Button

Press and hold the **POWER** button (Figure 2, Item 1) for 10 seconds.

The CapView will turn off.

CapView Turns Off While Flying

Figure 3: CapView Power Button

1. Press the **POWER** button (Figure 3, Item 1) on CapView to verify if the display will turn back on.
2. If the CapView does not turn back on, operate the spray handle to verify that the system will spray.

   If the system will spray, all valves will open to 100% duty cycle, and the aircraft will adjust the pressure to get the product out.

   Note: Over application may occur if an external rate controller is not used.
3. If the system will not spray, land to diagnose the problem.

Product Will Not Spray

If the product will not spray when the fan brake switch is disengaged and the spray handle is pushed:

1. If the Duty Cycle (DC) line on the CapView is showing off or 0%:
   a. Keep the spray handle in the down position.
   b. Use the **SWATHPRO BYPASS** switch to operate the valves.
      i. With the CapView on and profile selected, the valves will spray as usual.
      ii. With the CapView off, the valves will all open to 100% DC.
2. If the Duty Cycle (DC) line on the CapView is showing anything other than off or 0%:
   a. Verify there is product in the hopper.
   b. Verify the flow control valve is open.

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Section 4: Normal Procedures

Topics:

All normal procedures specified in the POH and associated supplements remain the same when the SwathPRO™ system is installed, with the exceptions of the additional SwathPRO™ system procedures listed in this section.

Ground Start

These procedures will energize and prepare the SwathPRO™ system for operation.

Note: Do not turn on the SwathPRO system until the amperage draw has normalized after starting the generator

Note: These procedures must be performed after the rate controller has been turned on.

1. Place the toggle switch labeled **SWATHPRO MAIN** in the on position.
2. Start the CapView.

   For more information, refer to Start the CapView.
3. Upload a profile (if the needed profile(s) have not been uploaded).

   For more information, refer to Upload a Profile to the CapView.
4. Select a profile.

   For more information, refer to Select a Profile.
5. Use the Wind Sensor Control screen (optional).

   For more information, refer to Wind Sensor Control.

After Landing

These procedures will turn off the SwathPRO™ system after operation.

1. Shut down the CapView by pressing the **POWER** button.
2. Place the toggle switch labeled **SWATHPRO MAIN** in the off position.

   For more information, refer to Shut down the CapView.

Agricultural Flying

Add these procedures to prepare the SwathPRO™ system to operate.

1. Operate in Auto or Manual mode.

   For more information, refer to Operate in Auto Mode or Operate in Manual Mode.
2. Operate the **RIGHT BOOM** switch (optional).

   For more information, refer to Operate the Right Boom Switch.
3. Operate the **NARROW SWATH** switch (optional).

   For more information, refer to Operate the Narrow Swath Switch.

Section 4A: Amplified Normal Procedures

Topics:

Start the CapView

Before starting the aircraft engine, ensure that the toggle switch labeled **SWATHPRO MAIN** is in the off position.

Figure 4: Power on the CapView

1. Start the aircraft engine and generator.
2. Allow amperage draw to normalize.
3. Place the toggle switch labeled **SWATHPRO MAIN** in the on position.
4. Press the **POWER** button (Figure 4, Item 1) to turn on the CapView display.
5. Read the message (Figure 4, Item 2) on the CapView.
6. Press the **ENTER** button (Figure 4, Item 3) when the guidance controller is ready to operate.
7. Take off and fly the aircraft to the desired application location.
8. Operate the SwathPRO™ system.

   Refer to the information below on how to operate in auto or manual mode.

   - Operate in Auto Mode
   - Operate in Manual Mode

Upload a Profile to the CapView

You must first make a profile using ProMaker. Refer to the ProMaker User Manual for more information.

Figure 5: Upload a Profile

1. Save the desired profile(s) from your computer to a USB memory device.
2. Insert the USB memory device into the port on the back of the CapView display.

   The **USB Host Menu** will show on the display screen.
3. Use the **UP** or **DOWN** arrow buttons (Figure 5, Item 1) to go to **Upload Profile** (Figure 5, Item 2).
4. Press the **ENTER** button (Figure 5, Item 3).
5. If at least one profile is on the USB memory device, an **Upload Profile Menu** screen will show.
   a. To upload a profile, use the up or down arrow buttons to select the desired profile name.
   b. Press the **ENTER** button.
   c. Select the profile number to save the profile.

      Choose from:

      - Press any one of the preset buttons (Figure 5, Item 4) to select where to save the profile.

        OR
      - Use the arrow buttons to select the desired preset number and then press the **ENTER** button.

   Note: If the number of valves that are built for the profile do not match the Total Number Valves Expected setting in the Capview, the profiles will not load.

   d. Repeat steps a to c to save profiles to all seven preset buttons.
6. When the uploads are complete, remove the USB memory device from the CapView.

Select a Profile

1. The profile(s) must be uploaded to the CapView display before you can select a profile for use while operating the system. For more information, refer to Upload a Profile to the CapView.

Figure 6: Select a Profile

2. Press and hold the desired preset button (Figure 6, Item 1).

   When the preset is selected, an LED (Figure 6, Item 2) will illuminate in the corner of the button.

   The profile name (Figure 6, Item 3) will show in the top center of the screen.

Operate in Auto Mode

Figure 7: Operation Screen—Auto Mode

1. Make sure that the circle at the top of the screen and the target pressure are green (Figure 7, Item 1).
   If the information is not in green, press the **ENTER** button (Figure 7, Item 2) until it shows green.
2. Select the desired profile.
   For more information, refer to Select a Profile.
3. Fly the aircraft over the desired application area.
4. If necessary, set the wind sensor information.
   For more information, refer to Wind Sensor Control.
5. Use the **UP** or **DOWN** arrow buttons (Figure 7, Item 3) to adjust the pressure set point, as necessary.

Operate in Manual Mode

Figure 8: Operation Screen—Manual Mode

1. Make sure that the circle at the top of the screen and the target pressure are white (Figure 8, Item 1).
   If the information is not in white, press the **ENTER** button (Figure 8, Item 2) until it shows white.
2. Select the desired profile.
   For more information, refer to Select a Profile.
3. Fly the aircraft over the desired application area.
4. Use the **UP** or **DOWN** arrow buttons (Figure 8, Item 3) to change the duty cycle of the valves, as necessary.

Wind Sensor Control

Figure 9: Wind Sensor Control Screen

Use of the Wind Sensor Control screen (Figure 9, Item 1) is optional.

1. Press the **ESCAPE** button (Figure 9, Item 2) while on the main operating screen to go to the Wind Sensor Control screen.
2. To start to use the wind sensor control, press the UP or DOWN arrow buttons (Figure 9, Item 3).
3. If you choose to use the screen, you need to set up the profiles for the wind patterns.

   For more information, refer to Change Wind Pattern Numbers System Settings.

Figure 10: Wind and Pattern Control Screen

4. After you have set the profiles for wind direction, the compass (Figure 10, Item 1) on the screen will show the corresponding numbers. The default profiles are shown on these graphics.
5. Use the arrow buttons (Figure 10, Item 2) to set the correct wind information.
6. The operator will have two choices for how to use the pattern control (Figure 10, Item 3) for selecting profiles, press the **ENTER** button to toggle between **Manual** and **Wind Vector** modes:
   - Manual—manually press the correct profile number as you change directions.
   - Wind Vector—the system will automatically change profiles to match flight direction with wind direction.

Change Wind Pattern Numbers System Settings

Figure 11: System Setup

1. Press the **SYSTEM SETUP** button (Figure 11, Item 1).
2. Use the **UP** or **DOWN** arrow buttons (Figure 11, Item 2) to go to the Headwind Pattern Number line (Figure 11, Item 3).
3. To change the profile number, press the **ENTER** button (Figure 11, Item 4).
4. Use the **UP** or **DOWN** arrow buttons to change the profile number.
5. When the correct profile number shows, press the **ENTER** button.
6. Use the **UP** or **DOWN** arrow buttons to go to the R to L Pattern Number line (Figure 11, Item 5).
7. To change the profile number, press the **ENTER** button.
8. Use the **UP** or **DOWN** arrow buttons to change the profile number.
9. When the correct profile number shows, press the **ENTER** button.
10. Use the **UP** or **DOWN** arrow buttons to go to the Tailwind Pattern Number line (Figure 11, Item 6).
11. To change the profile number, press the **ENTER** button.
12. Use the **UP** or **DOWN** arrow buttons to change the profile number.
13. When the correct profile number shows, press the **ENTER** button.
14. Use the **UP** or **DOWN** arrow buttons to go to the L to R Pattern Number line (Figure 11, Item 7).
15. To change the profile number, press the **ENTER** button.

16. Use the **UP** or **DOWN** arrow buttons to change the profile number.
17. When the correct profile number shows, press the **ENTER** button.
18. To go to the main operating screen, press the **ESCAPE** button (Figure 11, Item 8).

Operate the Right Boom Switch

Use this switch to turn the right boom on and off manually. (Figure 3, Item 3).

1. While operating the system, if you desire to operate the right boom, move the **RIGHT BOOM** switch to the **ON** position.
2. When you want to use both booms again, move the **RIGHT BOOM** switch to the **OFF** position.

Operate the Narrow Swath Switch

Use this switch to manually turn off the outermost valves on each boom. (Figure 2, Item 4).

1. While operating the system, if you desire to use a narrow swath instead of the full width of the booms, move the **NARROW SWATH** switch to the **ON** position.
2. When you want to use the full width swath again, move the **NARROW SWATH** switch to the **OFF** position.

Shut down the CapView

Figure 12: CapView

1. Press the **POWER** button (Figure 12, Item 1) to turn off the CapView.
2. Move the toggle switch labeled **SWATHPRO MAIN** to the **OFF** position.

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Section 5: Performance

All performance information specified in the POH and associated supplements remains unchanged when the SwathPRO™ system is installed.

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Section 6: Weight and Balance/Equipment List

Topics:

The weight range and center of gravity limits, aircraft loading, aircraft weighing procedure, and aircraft equipment list remain unchanged from the POH and associated supplements with the exception of:

Weight and Balance Record

Updated aircraft empty weight and balance records for the installation of the SwathPRO system.

Attach record here

Equipment Lists

Updated equipment list to reflect the installation of the SwathPRO™ system.

The total weight is the amount of weight that can be removed from the aircraft when changing from liquid application to dry application.

Table 4: Air Tractor 402 Equipment List

Description	Part Number	Qty	Weight per piece (lb)	Total weight
Kit, Boom, 17ft, 4" Spacing	320150-017-4	1 (2 booms)	81.24	162.48
Valve Assy, Center, SwathPRO	320015-108	6	0.49	2.94

Table 5: Air Tractor 502 Equipment List

Description	Part Number	Qty	Weight per piece (lb)	Total weight
Kit, Boom, 17ft, 4" Spacing	320150-017-4	1 (2 booms)	81.24	162.48
Valve Assy, Center, SwathPRO	320015-108	6	0.49	2.94

Table 6: Air Tractor 602 Equipment List

Description	Part Number	Qty	Weight per piece (lb)	Total weight
Kit, Boom, 19ft, 4" Spacing	320150-019-4	1 (2 booms)	91.00	182.00
Valve Assy, Center, SwathPRO	320015-108	6	0.49	2.94

Table 7: Air Tractor 802 Equipment List

Description	Part Number	Qty	Weight per piece (lb)	Total weight
Kit, Boom, 19ft, 4" Spacing	320150-019-4	1 (2 booms)	91.00	182.00
Valve Assy, Center, SwathPRO	320015-108	6	0.49	2.94

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Section 7: System Description

Topics:

This aircraft is equipped with a SwathPRO™ system, as described below. All other system descriptions and data in the POH and associated supplements remain unchanged.

SwathPRO™ is a networked control system in which each module contains a computer and communicates with other modules through a series of messages over a Control Area Network (CAN). System components include a CapView display unit, a power and control hub (Gateway hub), valve control modules (VCM), product delivery booms, and nozzle valves. The CapView display is an operator interface with a small color display and tactile buttons, allowing the pilot to make changes and monitor system operation. The Gateway hub is the power center, communication center, and the brain in the SwathPRO™ system, which executes most of the math involved in product control. The Gateway hub also distributes supply current and communication to a series of harnesses connected to the VCMs. The VCMs attach to, regulate, and monitor the operation of up to 15 individual nozzle control valves. The booms and valves distribute liquid product to the individually controlled spray nozzles allowing pattern control, rate control, and droplet size control.

CapView Description

The CapView display in the aircraft cockpit lets the pilot upload custom spray patterns and save preset pattern profiles for selection in-flight.

Figure 13: CapView Buttons

Table 8: CapView Button Descriptions

Item	Description	Function
1	ALARM	Silence the audible alarm
2	POWER	Start or shut down the CapView display
3	NOZZLE SETUP	Display the Nozzle Setup Menu
4	SYSTEM SETUP	Display the System Setup Menu
5	LOCATION SETUP	Display the Location Setup Menu Hold the button for 10 seconds to edit the Location Setup information
6	Presets	Store and select the prebuilt profiles
7	Navigation Arrows	Move through the menu items
8	ENTER	Main operating screen: Change between auto and manual operation mode System settings screens: Open the selected menu screen or to accept the selected value

Item	Description	Function
9	ESCAPE	Main operating screen: Display the Wind Sensor Control screen All other screens: Exit the current screen

Main Operation Screen

Figure 14: Operation Screen

The selected profile name (Figure 14, Item 1) shows at the top of the main operating screen.

The actual boom pressure (Figure 14, Item 2) shows inside the circle at the top center of the screen.

The target air speed and pressure set point (Figure 14, Item 3) shows on the top right side of the screen.

The user selected wind direction (Figure 14, Item 4) shows in the targeted information.

The user inputted wind speed (Figure 14, Item 5) shows below the targeted information.

When the system is in auto mode, the circle around the boom pressure and the pressure set point change to green. When in auto mode, the UP and DOWN arrow buttons (Figure 14, Item 6) can change the pressure set point. In manual mode, the icon will be in white, and the UP and DOWN arrow buttons can change the duty cycle.

To change between auto and manual mode, press the ENTER button (Figure 14, Item 7). The tip pressure (Figure 14, Item 8) is shown for both booms.

The graph (Figure 14, Item 9) on the bottom portion of the screen represents each nozzle and actual duty cycle.

Each nozzle is represented by a blue mark (Figure 14, Item 10).

The text box on the lower right side (Figure 14, Item 11) on the screen shows the nozzle diagnostic information for the nozzle with the yellow mark (Figure 14, Item 12) on the nozzle line.

The text box on the lower left side (Figure 14, Item 13) shows system diagnostic information.

Operation Modes

Manual mode

- The duty cycle stays at the value set in the profile, no matter the speed or pressure of the aircraft.
- Profiles are built using ProMaker, and flow is set by the chosen duty cycle.
- The operator can manually change the duty cycle, while the valves are pulsing, by using the up or down arrow buttons on the CapView.
- Boost is available.
  - When the operator manually increases the duty cycle, and it hits 100%, the boost turns on if a boost profile is currently selected.
- This operation mode does not care about the servo/flow control valve signal.
- This operation mode does not care about the flowmeter signal.

Auto mode

- The duty cycle is adjusted while flying to keep the rate on target no matter if flying upwind, downwind, or at a variable rate.
- Profiles are built with ProMaker, but the flow changes with the changes to the duty cycle when flying.
  1. When building profiles, it is recommended to set the duty cycle at 60% to 80%, so the system starts pulsing at that duty cycle, then changes as necessary.
  2. Boost nozzles can be selected on each profile to allow more flow on a downwind or variable rate scenario.
- This operation mode works with the servo/flow control valve signal.
  1. The system tees into the servo/flow control valve harness and pulls the servo/flow control valve signal into the Gateway hub. Then the signal is used to adjust the duty cycle based on what is called for by the rate controller.
  2. The system adjusts the servo/flow control valve to adjust the pressure. The system can hold the pressure constant in the boom no-matter what the duty cycle does. This will keep the VMD constant across the field no matter the speed or rate changes.
- Boost is available.
  - When the rate controller is calling for more flow, and the duty cycle of the main nozzles all hit 100%, the boost nozzles that were selected in ProMaker will turn on at 20% duty cycle, and the main nozzles will drop down to 80% duty cycle, then all nozzles that are on will work their way up from there.

System Setup Menus

System Setup Menu Descriptions

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
1	Operation Mode	Press **ENTER** to change	Auto
	The system can operate in two modes: **Auto** or Manual. In **Manual** mode, the rate controller adjusts the pressure, and the SwathPRO™ holds a constant duty cycle on the valves. In **Auto** mode, SwathPRO™ adjusts the servo (flow control valve) to hold the pressure constant and adjusts the duty cycle of the valves to vary the flow out of the tips.		
2	Controller Gallon Counter		0 Gallons
	Not used by the SwathPRO™ system		N/A
3	Actual Gallons Counter		0 Gallons
	Not used by the SwathPRO™ system		N/A
4	Controller Acre Counter		0.0 Acre
	Not used by the SwathPRO™ system		N/A
5	Actual Acre Counter		0.0 Acre
	Not used by the SwathPRO™ system		N/A
6	Controller Gallons per Minute		0 Gallons
	Not used by the SwathPRO™ system		N/A
7	Actual Gallons per Minute		0 Gallons
	Not used by the SwathPRO™ system		N/A
8	Nozzle Control (Key FOB)	Press **ENTER** to change	12V Active
	Default operation mode is **12V Active**. Use the **Key FOB Active** mode, during setup of the aircraft.		
9	Pressure 1		0 PSI
	The pressure 1 value is the boom spray pressure. This value is shown in the middle of the circle on the main operating screen.		
10	Target Air Speed	Press **ENTER** to change	150 MPH
	The speed at which the aircraft will fly.		
11	System Voltage		24.0 V
	The system voltage is the voltage at the Gateway hub. This can be an indicator of system health.		
12	Display Backlight	Press **ENTER** to change	10
	Larger numbers make the CapView screen brighter for daytime use. Smaller numbers make the CapView screen dimmer for night-time use. Range: 1-10, if 5 or less, the keypad backlight will turn on.		
13	LED Brightness	Press **ENTER** to change	5
	Larger numbers make the LED lights brighter for daytime use. Smaller numbers dim the LED lights for night-time use. Range: 1-10.		

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
14	Beeper Volume	Press **ENTER** to change	5
	Larger numbers make the alarm louder for outdoor use. Smaller numbers soften the alarm for indoor use. Range: 0-5, 0 turns off the beeper completely.		
15	Specific Gravity	Press **ENTER** to change	1.00
	Specific gravity is used to calculate tip pressure.		
16	Valve Diagnostics Enable	Press **ENTER** to change	Enabled
	If the system is not using nozzles that use the CapstanAG nozzle diagnostics properly, the nozzle diagnostics can be disabled here. CapstanAG uses this feature on demonstration units and development units where lights are substituted for valves or reset to coil only. Coil only disables the plunger movement detection without disabling short or open data.		
17	Headwind Pattern Number	Press **ENTER** to change	1
	If using the wind sensor, this value should be the profile number that is set up for the headwind flight pattern.		
18	R to L Pattern Number	Press **ENTER** to change	2
	If using the wind sensor, this value should be the profile number that is set up for the right to left flight pattern.		
19	Tailwind Pattern Number	Press **ENTER** to change	3
	If using the wind sensor, this value should be the profile number that is set up for the tailwind flight pattern.		
20	L to R Pattern Number	Press **ENTER** to change	4
	If using the wind sensor, this value should be the profile number that is set up for the left to right flight pattern.		
21	Rate Sync Mode	Press **ENTER** to change	ON
	Rate Sync™ changes the nozzle duty cycle based on the ground speed obtained from the GPS receiver.		
22	Rate Sync Average	Press **ENTER** to change	0.2
	The Rate Sync™ average represents how often the rate sync samples the speed from GPS. Higher values cause the system to react slower.		
23	Rate Sync Max Ground Speed	Press **ENTER** to change	300 MPH
	This number is auto calculated based on the profile Duty Cycles.		
24	Units	Press **ENTER** to change	US (PSI)
	Select the desired units of choice: US or SI units.		
25	Baud Rate		Searching
	This shows the GPS baud rate that is detected by the system. 19,200 to 115,200.		

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
26	Revision Information	Press **ENTER** to change then **YES**	XX
	The revision information includes all hardware items stored by the CAN address. The current versions of all hardware and software items on the system are shown in this list, including the CapView, Gateway hub, and VCM software version.		
27	Language	Press **ENTER** to change	English
	Select the desired language.		
28	Previous Error List	Press **ENTER** to change	N/A
	This displays the 50 most recent errors.		N/A
29	Advanced Settings		N/A
	Additional settings menu		N/A

Advanced Settings—Used in Auto and Manual Mode

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
1	Hour Meter		XX
	The hour meter shows the accumulated hours. The hour meter starts when at least one nozzle is on.		
2	Compass Heading	Press **ENTER** then **YES** to calibrate.	0 Degrees
	Not used by the SwathPRO™ system		
3	Compass Offset	Enter the offset to calibrate	0 Degrees
	Not used by the SwathPRO™ system		
4	USB Mode		Thumb Drive
	Thumb drive or **Computer**. **Thumb drive** must be chosen to utilize a USB drive for different purposes.		
5	Deadband Pressure	Press **ENTER** to change.	2 PSI
	The deadband pressure is used to tune out instability by providing a pressure zone that is considered satisfactory, thus requiring no action by the control system. The higher the number, the less sensitive the control system. To stabilize an oscillating system, use a higher number. To speed up a sluggish system, use a lower number. Range 0 to 100.		
6	Gain - System	Press **ENTER** to change.	0.7
	The system gain is used to tune pressure control. The system gain changes the total gain of the system according to the same ratios of proportional/ integral/differential gain established in those settings. The system gain number is the one most often used to tune sluggish or oscillating systems. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number.		
7	Gain - Proportional	Press **ENTER** to change.	5.0
	The proportional gain causes the control system to respond faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number.		
8	Gain - Integral	Press **ENTER** to change.	0.15
	The integral gain causes the control system to accelerate faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Integral gain is generally set at 1/10th of the proportional gain.		
9	Gain - Differential	Press **ENTER** to change.	0.0
	The differential gain causes the control system to accumulate errors faster when errors are small. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Differential gain is rarely used and is generally set at 1/10th of the integral gain or zero.		

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
10	Total Number Valve Expected	Press **ENTER** to change.	0 Valves
	The total number of valve expected value is the number of valves on the aircraft. At system power on, the system counts the number of valves reported by the VCMs. If the reported number matches the manually entered number for the value, the system operates normally. If an error is detected, an alarm will sound and diagnostic readouts will display. A damaged or corroded valve will trigger this error. The system cannot determine which nozzle is affected if the problem occurred when the system was powered off. Use the CapView location setup screen to look for a nozzle that is not connected.		
11	Scrolling Enable/Disable	Press **ENTER** to change.	Enabled
	For the nozzle diagnostics on the main operation screen, scroll from one nozzle to the next. To focus on a single nozzle without the scrolling, select Disable.		
12	GPS - Ant. Ahead of Rear Axle		0 Inches
	Not used by the SwathPRO™ system		N/A
13	GPS - Ant. Right of Center		0 Inches
	Not used by the SwathPRO™ system		N/A
14	GPS Antenna Above Ground		0 Inches
	Not used by the SwathPRO™ system		N/A
15	GPS Boom Ahead of Rear Axle		0 Inches
	Not used by the SwathPRO™ system		N/A
16	Forward/Reverse Detection		OFF=Fwd Rev Switch
	Not used by the SwathPRO™ system		N/A
17	Look Ahead Time	Press **ENTER** to change.	0.3 Seconds
	The look ahead time is based on the fastest field speed. The value is an indicator of how much time the GPS and the system take to react to coverage inputs. If the shutoff is too early, decrease the value. If the shutoff is too late, increase the value. Set the look ahead time value at the fastest travel speed expected. **Note:** When setting the overlap distance, set the Look Ahead Time value to 0.		
18	Zero Rate Shutoff	Press **ENTER** to change.	Minimum PWM%
	When set to **Shutoff**, the zero rate shutoff is enabled, and the system allows the duty cycle to drive to 0% or off. To disable the zero rate shutoff, set this to **Minimum PWM%**. The recommended setting is **Minimum PWM%**, where it only allows the system to go to the low limit nozzle PWM set on the **Nozzle PWM Minimum** line.		
19	Pressure Control Hold	Press **ENTER** to change.	1 Sec
	Auto mode operation pressure control hold must be set to 1.		
20	Pressure Sensor 1 Min. Volt	Press **ENTER** to change.	0.5 Volts
	Used to set up pressure sensor 1, which is the system spray pressure sensor.		

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
21	Pressure Sensor 1 Max. Volt	Press **ENTER** to change.	5.0 Volts
	Used to set up pressure sensor 1, which is the system spray pressure sensor.		
22	Pressure Sensor 1 Min. PSI	Press **ENTER** to change.	0 PSI
	Used to set up pressure sensor 1, which is the system spray pressure sensor.		
23	Pressure Sensor 1 Max. PSI	Press **ENTER** to change.	100 PSI
	Used to set up pressure sensor 1, which is the system spray pressure sensor.		
24	Pressure Sensor 1 Offset	Press **ENTER** to change.	0.0 PSI
	It is common to have 1 to 5 VDC sensors and 0.5 to 5 VDC sensors. The PSI sensor offset is used when the sensor does not match a gauge. Entering an offset value will scale the sensor up or down. The allowable range is ±1-9.		
25	Servo Type	Press **ENTER** to change.	Inline Valve
	Air Tractor airplanes will use **Inline Valve**.		
26	Manual Mode Servo Speed	Press **ENTER** to change.	50%
	The manual mode servo speed controls how fast the pressure changes in manual mode. If the valve operates too slowly in manual mode, increase this value. If the valve operates too quickly in manual mode, decrease this value.		
27	Servo Output Minimum DC%	Press **ENTER** to change.	0%
	Servo output minimum is a kick-start for the servo/flow control valve. Typically a servo duty of 5% will not make the servo/flow control valve move at all because of the static friction in the valve. The servo output minimum supplies a minimum duty at which the valve will move. A pressure dead-band is used to prevent constant cycling of the valve.		
28	Servo Output Maximum DC%	Press **ENTER** to change.	100%
	Servo output maximum limits the maximum speed of the pressure control servo/flow control valve. The inertia of the valve motor can cause the valve to overshoot when controlling pressure. Limiting the output maximum can assist the PID control algorithm to accurately regulate pressure. A typical value may be 75% in order to slow the maximum speed of the valve.		
29	Servo Input Minimum DC%		35%
	Servo input minimum is the minimum duty cycle from the rate controller, which will cause the nozzle duty cycle to move. Making this number larger will prevent small fluctuations in the servo duty cycle from changing the nozzle duty cycle.		
30	Pump Seal Shutdown		3.0 PSI
	Not used by the SwathPRO™ system.		N/A
31	Nozzle PWM% Cycle Time	Press **ENTER** to change.	2.5 Seconds
	The nozzle PWM% cycle time value only affects in-line or bypass valve servo types. The PWM% cycle time (2.5 seconds) is the time it takes for the pulsing nozzles to modulate from minimum to maximum duty cycle. To speed up a sluggish system reaction time, enter a lower number. To slow down the reaction time of an oscillating system, enter a higher number.		

Line Number	Line Title	Action	Default Setting
	Description		Actual Setting
32	Nozzle Pulse Frequency	Press **ENTER** to change.	20 Pulse/S.
	The SwathPRO™ spray systems run at 20 pulses per second pulse frequency. CapstanAG does not recommend pulse frequencies slower than 10Hz in spray applications.		
33	Nozzle PWM Minimum	Press **ENTER** to change.	20%
	The nozzle PWM minimum value is the minimum pulse duty cycle for the nozzle valves. You may not change this value any less than the Nozzle Pulse Frequency value. If the Nozzle Pulse Frequency is set to 20 pulses, then the nozzle PWM minimum must be set to 20 or higher. If you are uncomfortable about running low duty cycles, then this value can be set higher.		
34	Nozzle PWM Maximum	Press **ENTER** to change.	100%
	It is unlikely that you would set the nozzle PWM maximum lower than 100%. This is where the limit to the maximum duty cycle would be set.		
35	Flowmeter Minimum GPM	Press **ENTER** to change.	10 GPM
	Not used by the SwathPRO™ system		
36	Flowmeter Output Type	Press **ENTER** to change.	Correction
	Not used by the SwathPRO™ system		
37	Flowmeter Calibration	Press **ENTER** to change.	1400P/10 GAL
	Not used by the SwathPRO™ system		
38	Boom OFF Delay	Press **ENTER** to change.	0.15 s
	The Boom OFF Delay refers to the time it takes for the nozzle valves to close after shutting off the spray.		
39	Boom ON Delay	Press **ENTER** to change.	0.00 s
	The Boom ON Delay refers to the time it takes for the nozzle valves to open after turning on the spray.		
40	Minimum Valves ON	Press **ENTER** to change.	1 Valve
	Not used by the SwathPRO™ system		
41	Factory Reset	Press **ENTER** then **YES** to change.	N/A
	The factory reset will require all setups in the entire system to be reset to default. A factory reset is required when repairing the system. Make sure that you have recorded the setups you prefer before resetting. With a properly prepared “cheat sheet,” a factory reset only takes a few minutes. If major components are changed, a factory reset may need to be performed.		N/A
42	Contact Information		N/A
	Selecting this line will open up a page with the CapstanAG toll-free phone number, website, and a QR code that will direct you to the website.		N/A

Switch Descriptions

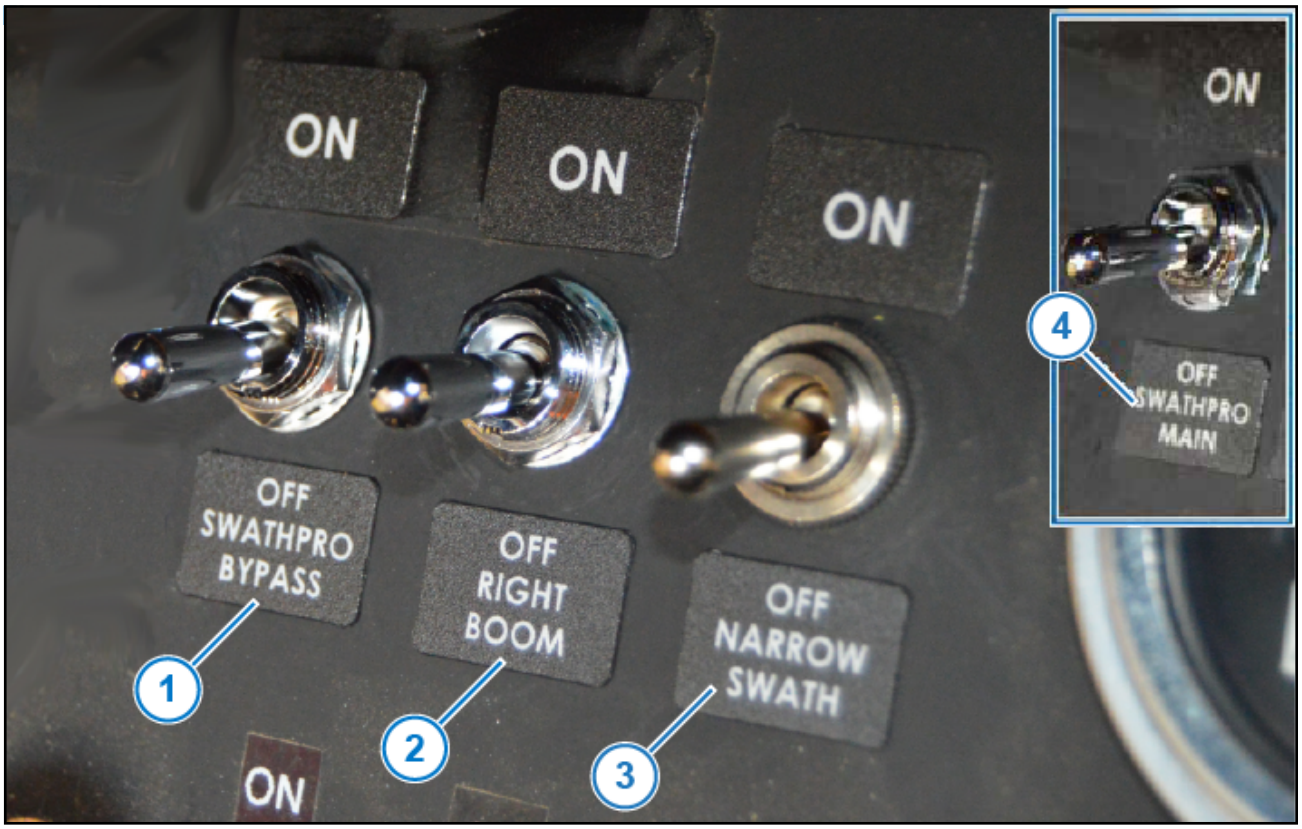

Figure 15: SwathPRO Cockpit Switches

Note: Each aircraft is set up differently. Mounting locations can vary with each installation.

Table 9: SwathPRO Switches

Item	Name	Description
1	**SWATHPRO BYPASS** Switch	Use this switch to turn the booms on and off manually. This switch is used if the microswitch stops working.
2	**RIGHT BOOM** Switch	Use this switch to turn on and off the right boom shutoff.
3	**NARROW SWATH** Switch	Use this switch to turn on and off the outermost valves on each boom.
4	**SWATHPRO MAIN** switch	Use this switch to supply or disable power to the system.

SWATHPRO MAIN Circuit Breaker

Figure 16: Circuit Breaker

The circuit breaker labeled **SWATHPRO MAIN CB**, located in the engine bay, is shown in the correct operating position. This switch controls the primary power to the system. When the switch is in the off position, the system is fully disabled.

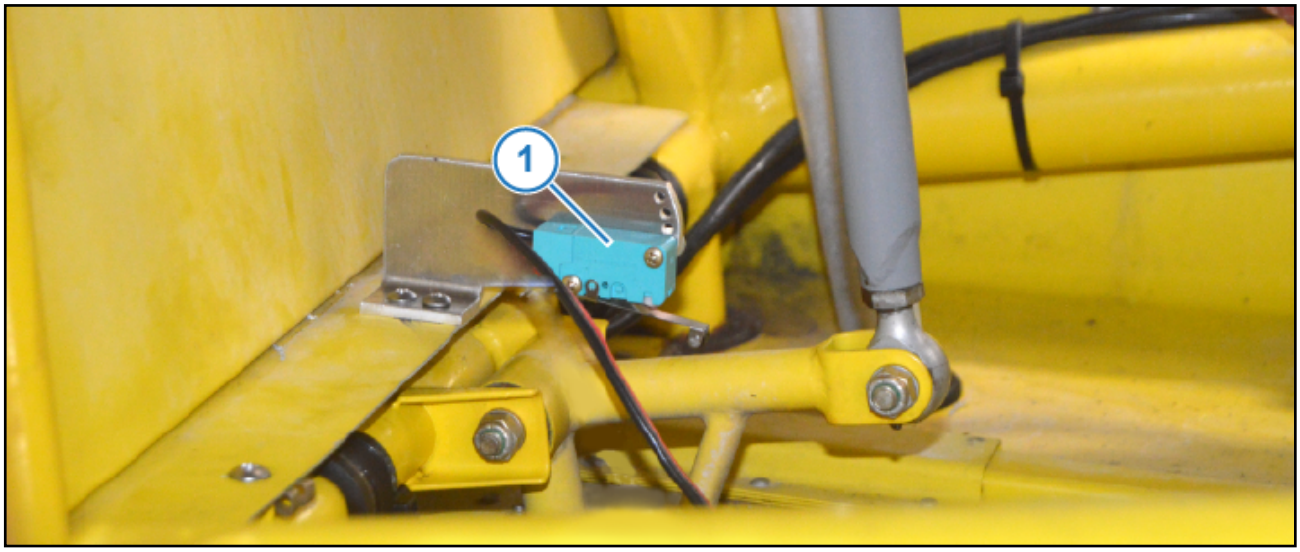

Figure 17: Microswitch

The microswitch is located at the bottom of the spray handle. It is used to engage or disengage the nozzle valves. When the spray handle is in the up position, the nozzle valves are disengaged. When the spray handle is in the down position, the nozzle valves are engaged.

Move the spray handle up and down to operate the microswitch (Figure 17, Item 1).

If the microswitch is not operating correctly, refer to Operate the SwathPRO Bypass Switch or Spray Without the Microswitch.

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Section 8: Handling, Service, and Maintenance

All maintenance specified procedures specified in the POH and associated supplements remain unchanged when the SwathPRO™ system is installed.

For maintenance requirements of the SwathPRO™ system, refer to the Instructions for Continued Airworthiness, 320700-005.

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Index

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