

# **WAG Flagger 2000**

# **INSTRUCTION MANUAL**

**Revision: B**

**Date: April 19, 2002**

**WAG Flagger 2000**  
**INSTRUCTION MANUAL**  
**Record of Revision**

<b>Rev #</b>	<b>Page</b>	<b>Record of Revision</b>	<b>Date</b>	<b>Approval</b>
IR	All	Initial Release	08/23/99	JAD
A	36	Changed Round Robin to Racetrack	03/05/02	JAD
B	21	Correct wording in step "d", "e" & "h"	04/19/02	JAD

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## **WARRANTY POLICY**

WAG Corporation warrants that all of its products are free from defects in material and workmanship, for one year, subject to the conditions set forth below:

Dates of sale will mean two days after the unit has been shipped. WAG Corporation's responsibility respecting this warranty is limited solely to product replacement or product repair at WAG Corporation or an authorized WAG dealer only. Determination of replacement or repair will be made by WAG Corporation personnel or by a WAG dealer authorized for this purpose.

This warranty will not extend to damage or failure resulting from misuse, neglect, accident, abuse, improper installation, or operation in an environment other than that intended.

In no event will WAG Corporation be liable for an indirect incidental, special or consequential damages whether through tort contact, or otherwise. This warranty is expressly in lieu of all other warranties, expressed or implied, without limitation, the implied warranties of merchantability or fitness for a particular purpose.



## I. Introduction:

The WAG Flagger 2000 is a precision guidance system which utilizes the Global Positioning Satellite System (GPS.) We at WAG Corporation have designed the WAG Flagger 2000 based upon what you, the Pilots, have told us. As a result, the WAG Flagger 2000 is the easiest system to operate on the market.

**The WAG Flagger 2000 is an extremely user friendly system that uses a Windows™ type format. With the WAG Flagger 2000, instead of “clicking” on a particular icon for a function, the operator presses the “number” displayed beside the desired function.**

The WAG Flagger 2000 comes with a one year warranty on all parts and services. The differential correction is transmitted in several differential frequencies ranging from U. S. Coast Guard Beacon at 300 KHz to a satellite signal at 1.5 GHz. Your system is configured to use at least one of these signals and sometimes more.

## II. Features:

The WAG Flagger 2000 provides fourteen distinct spraying patterns with variations for many of the patterns. These patterns can also be combined to allow unlimited possibilities. The patterns were designed with the convenience of the pilot, efficiency of fuel consumption, and product application in mind. The unique Tandem Patterns of the WAG Flagger 2000 also prevent the second pilot from flying into the spray of the First Pilot.

The WAG Flagger 2000 Approach™ Lightbar provides immediate visual feedback to the pilot if the GPS or differential correction signals are lost. With the WAG Flagger 2000, the pilot can always be confident of the accuracy of the system. A new feature of the Lightbar is its ability to warn the pilot when differential correction is approaching the maximum age limit. This gives the pilot enough warning so the appropriate actions can be taken to ensure the accuracy of the system.

Another feature of the WAG Flagger 2000 is the use of "Save Point/Pattern." The WAG Flagger 2000 has 700 "Save Point/Patterns" which save and store the current job in progress. The Save Point/Pattern is used when the pilot has to stop the treatment of the field before it is finished or to return to the point in the swath where his load ran out. There are many other features of the WAG Flagger 2000 and a more detail discussion will follow.

## III. Components:

The WAG Flagger 2000 has three main components. The following is a brief description of each component and their function.

### A. *Approach™ Lightbar:*

The Approach™ Lightbar has a four Alphanumeric LED's and each side. It also has row of LED's across the top and bottom with Twenty LED's between them. Each row contains sixteen LED's on each side of the center vertical LED's. The bottom row of LED's represent the Cross track and the value that each LED represents is programmable in the

Lightbar Menu. The cross track is the distance between the location of the airplane and the center of the swath. The operator simply flies in the direction the LED's are indicating, until the center LED'S are illuminate. The top row of LED's represent the angle the airplane is approaching the swath. The value of these LED's can also be programmed in the Lightbar Menu.

**NOTE:** The GPS receiver is only capable of reporting the direction of the travel. That is, both the Heading and Intercept Angle are "undefined" (unstable) when the airplane is not moving.

### **B. Control Pad:**

The Control Pad is the component by which the operator inputs the various commands. It is usually located lower in the cockpit since the operator does not have to obtain information from the Control Pad while he is actually applying the chemicals.

### **C. WAGSTAR:**

The Control Box contains the various receivers the WAG Flagger 2000 can be configured with. It can be located in an obscure place since access to the box is seldom required or since it is so small it can also be put in the cockpit.

## **IV. Startup:**

### **A. Power**

1. The WAG Flagger 2000 is connected to the main bus in the cockpit and thus does not draw any power from the aircraft's battery when it is OFF. Turn the "Power" switch on the Control Pad clockwise to turn the system on. The WAG Flagger 2000 will reset the GPS card and then wait for the system to obtain the GPS lock. This may take about three minutes. If the lock is not obtained in the three minutes, simply press "Restart." If the problem continues, follow the instructions of the Control Pad display.
2. After obtaining a "GPS Lock", the system will then search for the Differential signal. If the signal is not obtained, follow the instructions on the Control Pad or refer to the "Trouble Shooting" section on the manual.
3. After obtaining the Differential Signal, the WAG Flagger 2000 will run a diagnostics check on the Data Logger and the other peripherals the system may be configured with. If the Data Logger or other equipment is not functioning properly, follow the instructions on the Control Pad or refer to the "Trouble Shooting" section of the manual.

4. After the WAG Flagger 2000 determines all the various components are OK, it will enter the "Ready to Work" mode. In this mode, the Control Pad will display the following:

```
WAG Flagger 2000 v1.10
Parallel
SW: 60      DF: S/540
Parallel    ---->
```

The text on the Lightbar will display:

```
WAIT    >>A
```

Where "v 1.10" is the software version, "SW: 60" is the swath width (which may be different depending on the value assigned), "DF: S/540" is the differential correction station in use (which may be different depending on the type of differential source the system is equipped with), "Parallel" is the pattern and "---->" is the work direction which is to the right in this example.

When the WAG Flagger 2000 has entered the "Ready to Work" mode, this indicates to the operator the system is ready and all the functions of the system can be accessed.

**NOTE:** Once the operator has pressed the Flagger Switch to set an "A" point, the WAG Flagger 2000 then enters the "Working" mode. All functions which are accessed in the "Ready to Work" mode can also be accessed in the "Working" mode.

## **B. *Brightness:***

The brightness of the keys and the display on the Control Pad are adjusted by turning the "Power" switch. Turning the switch clockwise all the way maximizes the brightness. When turning the switch counterclockwise, the back light on the display dims first and then the keys will dim. This allows the pilot to turn the display OFF, but still see the keys during night operations.

The brightness of the Approach <sup>TM</sup> Lightbar is adjusted in the Lightbar menu in Setup. Refer to the Lightbar section for more details.

## **C. *Restart:***

"Restart" is a software reboot and is primarily used as a diagnostic aid. The benefit of using this function is it restarts the system while preventing the GPS card from losing the satellites it is tracking.

## **D. *Soft boot:***

The "Soft boot" switch is the equivalent to pressing "Reset" on a desk top PC. It is activated by turning the "Contrast" switch counterclockwise until it clicks, and then turning it back again. Like "Restart," the "Soft boot" is used as a diagnostic aid, and it also will

prevent the GPS card from losing the locks on the GPS satellites. Use the "Soft boot" when the "Restart" does not work.

### **E. Contrast:**

The contrast of the display on the Control Pad can be adjusted by turning the "Contrast" switch.

## **V. Approach™ Lightbar:**

The Approach™ Lightbar is the latest in lightbar design. It can be configured to indicate the course direction either with the traditional design or with the new Approach™ design. Designing the lightbar will be discussed in the "Setup" portion of this manual. This section explains the various features of the Approach™ Lightbar and its operation.

The Cross Track LED's, the bottom row of LED's, indicates how far the aircraft is from the center on the swath. If the Approach™ is designed with the In other words, if the lights on the left side of the center LED's, then you need to fly to the left. The "Intercept Angle", top row of LED's, are indicating which side of the intended swath the aircraft is on and the angle the aircraft is traveling with respect to the swath. For example, the airplane is approaching the swath from the right side at a 30 degree angle. The lights on the right side of the center LED's will be ON, which is indicating to the pilot the aircraft is on the right side and the number of LED's ON will represent the angle.

WAG Corporation was the first to design a Lightbar that visually shows the pilot when the differential signal or GPS lock is lost. It also shows the pilot if the age of the differential signal is exceeding the preset limits. The new Approach™ Lightbar gives the pilot the same heads up indications of these various functions. When the differential signal is lost, the first five lights on each side of the center lights will come ON and the text displays "No Diff". When the GPS lock is lost, all the lights on each side of center lights will be ON and the text displays "No GPS". The NO Diff lights, NO GPS lights and the warnings displayed on the text will go OFF when the signals have been received again by the WAG Flagger 2000.

**NOTE:** The GPS lock always has priority over the differential signal. That is, if you lose the differential signal and the GPS lock at the same time, only the GPS lock lights will be illuminated. If you still do not have a differential signal when GPS lock is regained, then the NO Differential lights will be illuminated.

The strobe feature of the Approach™ Lightbar is unique to all WAG guidance systems. Each time the Flagger Switch is pressed to set an "A," "B" or "C," point the bottom row of LED's will strobe. This feature assures the operator the point was set by the system.

Another unique feature of the WAG Flagger 2000 is the "flipping" of the Approach™ Lightbar each time the system is advanced to the next swath. To understand this, imagine the WAG Flagger 2000 actually turning the Approach™ Lightbar over. The reason for this feature is to eliminate the need to keep up with the swath count. With this feature, if the operator forgets to advance to the next swath the Approach™ Lightbar will work backwards. Meaning when steering toward the light, the lights move away from the center LED's instead of towards them. If this happens, simply press the Flagger Switch and then fly as indicated by the lightbar.

**NOTE:** Since the Approach™ Lightbar flips when the Flagger Switch is pressed for the next swath, the cross track indications will be backwards so long as the field is behind the operator. Once the

operator has turned far enough so that the field is in front, his orientation of the Approach™ Lightbar to the field will be correct.

To ensure accuracy of the WAG Flagger 2000, the age of the differential correction is closely monitored by the system. When the differential correction is about to exceed the age limit, the WAG Flagger 2000 warns the operator by flashing the bottom of LED's ON and OFF. For example, if the pilot sets the warning time to five seconds, the Approach Lightbar will start to blink five seconds before the "No differential" lights come on. However, if a new differential correction signal is received before the five seconds expires, the Approach™ Lightbar will stop blinking. This warning allows the pilot to take the appropriate action to ensure the accuracy of the job.

## **VI. Setup:**

The WAG Flagger 2000 is designed to reduce operator input while actually doing a job. Various programmable functions, however, are programmed in the "Setup" function of the system. Once these settings are programmed, the WAG Flagger 2000 will store them in memory.

**NOTE:** The "Setup" function is accessed by pressing the "Setup" key when the WAG Flagger 2000 is in the "Ready to Work" mode or the "Working" mode.

Once the Setup Menu is accessed the various functions of the system that can be programmed are then accessed by pressing the number beside the function. To scroll the Setup menu to the next page, press "4" which is the number beside "More".

The "Setup" key also has two other functions:

1. Pressing "Setup" twice will access the Differential Age, Number of GPS satellites, Differential Count and HDOP.
2. Pressing "Setup" three times accesses some of the differential receivers the WAG Flagger 2000 supports. See Trouble Shooting for use of this function.

### **A. Approach™ Lightbar setup:**

The Lightbar Setup menu has five programmable functions: 1) Brightness, 2) Distance, 3) Degrees, 4) Scroll and 5) Design. The Lightbar Setup menu is accessed by pressing a "1" in the "Setup" menu.

#### **1. Brightness level:**

The brightness of the Approach™ Lightbar can be adjusted to a number of different levels. To change the brightness of the Approach™ Lightbar, simply select "Brightness Level" in the Lightbar menu and then the desired level. This will change the brightness of the LED bulbs. Once a level has been selected, press "Backspace" and the operator can then set the brightness level of the text. Press "Backspace" again and the WAG Flagger 2000 will return to the "Ready to Work" mode.

**NOTE:** If the WAG Flagger 2000 is in the "Working" mode when a particular function is accessed, upon completing the function the WAG Flagger 2000 will return to the "Working" mode instead of the "Ready to Work" mode.

## 2. Approach™ Lightbar Distance, (cross track):

The Approach™ Lightbar has 16 lights on each side of the center lights on the top and bottom row. The value of each of these lights on each row can be set to by the user. The bottom row, Cross Track, and the two rows above the bottom row work together providing a large “volume” of lights for easier operations. The top row of lights and the row of LED’s below, also work together for easier operations. The cross track can be programmed in increments as small as six inches, or .2 meter, and the Intercept Angle, can be programmed in increments as small as one-tenth of a degree. After gaining some experience with the WAG Flagger 2000, the operator may want to change the configuration of the Approach™ Lightbar.

Steps for programming the Approach Lightbar:

- a. Access the “Lightbar Distance” menu from the “Lightbar Setup” menu;
- b. When the “Lightbar Distance” menu has been accessed, the Control Pad will display the following;

Lightbar Distance:

```
1=5    2=8
3=12   4=16
5=20   6=24
```

The numbers preceding the “=” represent the position of the LED on the Approach™ Lightbar. The “1” represents the first LED on each side of the center LED’s. The “5” displayed next to “1=” means the first LED next to the center LED’s will come on when the Cross Track is **greater than** five feet (or meters if in metric) from the center of the swath.

Notice the cursor is under the “5.” If you wish to change the number, enter the desired number by pressing the corresponding key. While entering a number, you can press “Backspace” and the cursor will backup to the previous position. After you enter the number, press “Enter” and the cursor will move over to the “8.” If “8” is acceptable, press “Enter” and the cursor will move down to the “12”, and so on. When “Enter” is pressed after the 6<sup>th</sup> LED, the display will change and show the 7<sup>th</sup> to the 12<sup>th</sup> LED and their values. When “Enter” is pressed after the 12<sup>th</sup> LED, the display will change and show the last 5 LED’s. When you press “Enter” after the 16<sup>th</sup> LED, then press “**Backspace**” and the system will advance to programming the “Intercept Angle”, top row of LED’s. The Control Pad will display the following:

Intercept Angle:

```
1=5    2=8
3=12   4=16
5=20   6=24
```

Program the LED’s for the Intercept Angle the same way as the Lightbar Distance.

**NOTE:** The Intercept Angle LED’s can be programmed to tenths of a degree, example 1.1 degree.

**NOTE:** The values for the LED's must be in ascending order or the Approach™ Lightbar will not function properly.

**NOTE:** When a particular function has been accessed that requires the inputting of numbers, the "Backspace" key can be used to "back up" to the previous position.

### **3. Degrees:**

The text on the Approach™ Lightbar will always show the Swath Count on the left side, and the Cross Track on the right side. In addition to the text the LED's on the bottom indicate the Cross Track and the LED's on the top of the Approach™ Lightbar indicate the intercept angle.

### **4. Scroll:**

In this mode, the operator can program the information the WAG Flagger 2000 will display in the various operating modes. The following are the names of the operating modes, a brief description of each and a list of the information that can be displayed in each mode. The information can be displayed in several different groups with a maximum of two types of information in each group.

#### **a. Operating Modes:**

##### **1. Swath:**

This is the mode the system is in when the actual treatment of the crop is in progress, it is also the same as the "Working" mode. It is called "Swath" simply because the operator is treating one swath after another. This mode is automatically entered when the "A" point of the first swath is established. The following can be displayed in this mode: **1<sup>st</sup> Group** 1. Swath Count and Cross Track; **2<sup>nd</sup> Group** 1. Acres/Pass and 2. Acres/Field; **3<sup>rd</sup> Group** 1. Gnd Spd (Ground Speed) and 2. Vert. Spd. (Vertical Speed); **4<sup>th</sup> Group** Current Time; **5<sup>th</sup> Group** Current Date; **6<sup>th</sup> Group** 1. Dist. A-B (the distance between the A and B points), 2. Dist. B-C (the distance between the A-B line and the C point, when a pattern with a "C" point is being used).

**NOTE:** Each group of information is accessed by pressing the "Scroll" key. The first group of information is the basic information required to operate in each given mode and thus, this is the information displayed first when the mode is activated.

##### **2. Save Point/Pattern:**

This is the "Save Point/Pattern" option which is used when the plane must leave the job either in the middle of a swath or to save a job that has not been completed.

**NOTE:** It is not necessary to use Save Point/Pattern when leaving the field for another load.

The following can be displayed when in this mode: **1<sup>st</sup> Group** 1. Intercept Angle, 2. Distance To (this is the distance to the point where the Flagger Switch was pressed); **2<sup>nd</sup> Group** 1. Heading and Bearing; **3<sup>rd</sup> Group** 1. Heading, and 2. Cross Track; **4<sup>th</sup> Group** 1. Saved Point, 2. Gnd. Spd and 3. Vert. Spd; **5<sup>th</sup> Group** 1. Current Pattern and 2. Swath; **6<sup>th</sup> Group** 1. Dist. A-B and 2. Dist. B-C (when the pattern uses a "C" point ; **7<sup>th</sup> Group** "A" Latitude; **8<sup>th</sup> Group** "A" Longitude; **9<sup>th</sup> Group** "B" Latitude; **10<sup>th</sup> Group** "B" Longitude; **11<sup>th</sup> Group** "C" Latitude (if the pattern has a "C" point); **12<sup>th</sup> Group** 1. "C" Longitude (if the pattern has a "C" point).

### **3. *Lat/Lon:***

This mode is used when the operator wants the WAG Flagger 2000 to function like a normal GPS. The following can be displayed in this mode: **1<sup>st</sup> Group** 1. Compass Heading and 2. Bearing; **2<sup>nd</sup> Group** Distance to the point; **3<sup>rd</sup> Group** 1. Lat/Lon Number, 2. Gnd. Spd and 3. Vert. Spd. ; **4<sup>th</sup> Group** Latitude; **5<sup>th</sup> Group** Longitude.

### **4. *Homepoint:***

This mode is used when the plane is ferrying and the pilot wants to fly a straight line back to the base for another load. The following information can be displayed in this mode: **1<sup>st</sup> Group** 1. Heading and 2. Bearing; **2<sup>nd</sup> Group** Distance to the "B" point; **3<sup>rd</sup> Group** 1. Homepoint #; 2. Gnd Spd. and 3. Vert Spd; **4<sup>th</sup> Group** "A" Latitude; **5<sup>th</sup> Group** "A" Longitude; **6<sup>th</sup> Group** "B" Latitude; **7<sup>th</sup> Group** "B" Longitude.

### **5. *Return to Field:***

This is the mode the WAG Flagger 2000 enters after the Homepoint is used and is activated simply by pressing the Flagger Switch. In this mode, the WAG Flagger 2000 guides the pilot back to the field after getting a new load. The following can be displayed in this mode: **1<sup>st</sup> Group** 1. Heading and 2. Bearing; **2<sup>nd</sup> Group** Distance to the point; **3<sup>rd</sup> Group** 1. Gnd. Spd and 2. Vert. Spd; **4<sup>th</sup> Group** 1. Dist. A-B and 2. Dist. B-C (when the pattern has a "C" point); **5<sup>th</sup> Group** "A" Latitude; **6<sup>th</sup> Group** "A" Longitude; **7<sup>th</sup> Group** "B" Latitude; **8<sup>th</sup> Group** "B" Longitude; **9<sup>th</sup> Group** "C" Latitude (if the pattern has "C" point); **10<sup>th</sup> Group** "C" Longitude (if the pattern has a "C" point).

## b. Programming Swath Mode:

Programming the "Scroll Setup" is the same for all the operating modes. Thus, the manual will demonstrate the programming of the Swath mode. To change the other modes, simply select the particular mode and proceed with the following steps.

1. To access the "Scroll Setup" menu, select "Scroll" in the Lightbar Setup menu. Then access the "Swath" mode by selecting "Swath" in the "Scroll Setup" menu.

**NOTE:** Other modes can be displayed by selecting "More."

The description of the information in the **1<sup>st</sup> Group** will be displayed on the Control Pad as follows:

1. Swath count +
2. Cross Track +

And the Approach Lightbar text will show:

5. ALL 6. NONE 7. ✕ 8. ⊕

2. The "+" beside each description means the information will be displayed on the Approach™ Lightbar text. Pressing the number beside the description will change the "+" to a "-" which means the information will not be displayed. If the pilot presses a "5", then all the information will be displayed and likewise if the pilot presses a "6" all the information will not be displayed. Pressing "7" will advance to the next screen in the Swath mode and pressing "8" will return to the previous screen.

3. After making the selections, press "7" and the **2<sup>nd</sup> Group** of information will be displayed:

1. Acres/Pass +
2. Acres/Field +

As in Step 2, pressing the number beside the description will determine whether the information will be displayed or not.

4. Continue the above sequence until pressing the "7" does not move to a new screen. Then press "Enter" and the WAG Flagger 2000 will accept your changes and return to the "Ready to Work" mode.

## c. Programming Other Modes:

To program all of the other modes, simply repeat the above 4 steps making the appropriate selection in Step 1.

## 5. Design:

In this mode the operator designs the Approach™ Lightbar to his personal preference. There are two basic designs, 1) Approach which resembles the view of the a runway on final approach and 2) “X” (Cross) Track which is similar to the traditional way of indicating course direction with LED’s on each side for the center LED’s. Each basic design can also be configured as to the corrective direction the LED’s are indicating. If the operator chooses “Aviation”, then if the LED’s on the right side of the center LED’s are ON, the pilot flies the aircraft to the right. If the operator chooses “Ground”, and the LED’s are ON, on the right sided of the center LED’s, then the pilot flies the aircraft to the left.

With the Approach™ Lightbar designed using the “X Track” the pilot can also choose three different color schemes. One scheme has the LED’s on the left side of the center LED’s red and the LED’s on the right side green. Another scheme has the LED’s on the right side red and the left side green, and still another way is to have the LED’s on both sides red.

The Approach design of the lightbar has four different choices which simply determines how wide the “runway” will be. “Approach 1” is the narrowest and “Approach 4” is the widest. When using the Approach style lightbar the pilot keeps the aircraft “on the runway”. The LED’s between the runway boundary are green and the ones on or outside the boundary are red. So long as the pilot keeps the aircraft “on the runway” he has green lights ON indicating he is on track. As he approach the edge of the runway the red LED’s start to come ON indicating he is approach the edge of his intended path or is outside the intended path. If he starts to get too far from the center, then some red LED’s start to come ON. Below are diagrams of the various designs of the Approach™ lightbar:

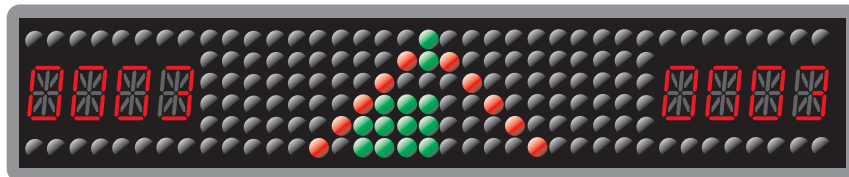


Figure A. Approach 1

The design has the narrowest critical path with only two increments before displaying the warning of approaching the edge of the intended path.

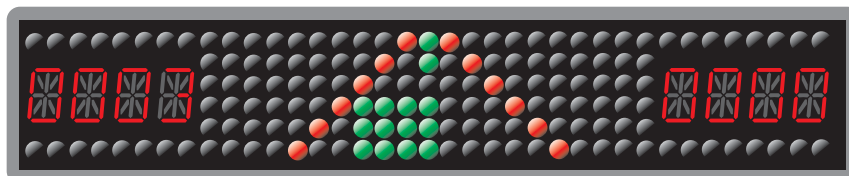


Figure B. Approach 2

This design has a wider critical path.

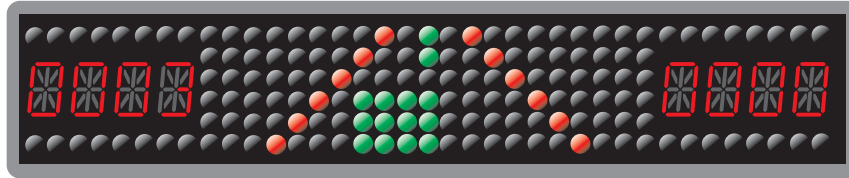


Figure C. Approach 3

Approach 3 has four increments before the Red LED's start to indicate the edge of the critical path is being reached.

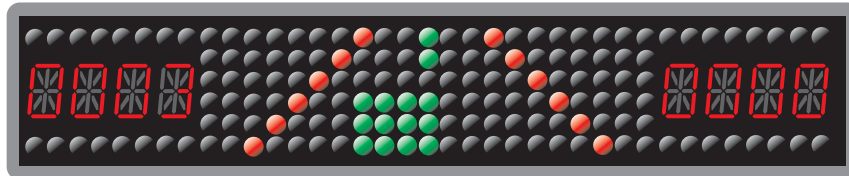


Figure D. Approach 4

This design give the widest critical path with 5 increments before the warning appears.

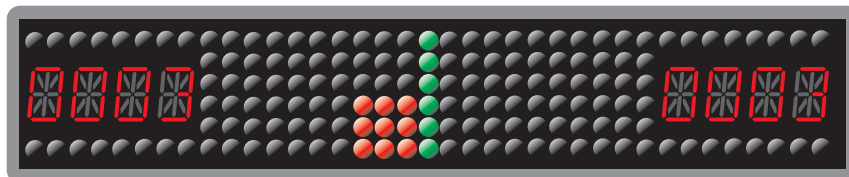


Figure E. Three Row X Track

This design is the traditional method of indicating coarse correction. It does not have any out critical boundary, however there are three different color combination which can be used. One is red LED's on both side of the center line and another is red LED's on the left side and green LED's on the right side. Still a third way to design the lightbar is with red LED's on the right side and green LED's on the left.

## **B. Patterns setup:**

In this mode, the WAG Flagger 2000 is programmed to fly two planes in a tandem pattern, either Parallel or Racetrack, with both planes having either the same size swaths or different size swaths. The WAG Flagger 2000 is shipped with the Tandem Patterns set to the following:

1. **Tandem Parallel is set up to fly both planes with the same swath width.**
2. **Tandem Racetrack is set up to fly both planes with the same swath width.**

If this programming format is acceptable, proceed to "Differential Setup." To change the format, proceed as follows:

## 1. Tandem Racetrack:

- a. Access Tandem Racetrack by selecting "Patterns" in the Setup Menu and then choose "Tandem Racetrack";
- b. Select the desired type of pattern. After the selection is made, the WAG Flagger 2000 will return to the "Ready to Work" mode.

## 2. Tandem Parallel:

To program "Tandem Parallel", follow the same steps as in "Tandem Racetrack" except select "Tandem Parallel" in the "Patterns Setup" menu.

## 3. Review Patterns:

To review the current configuration of the Patterns, select "Review Options" in the "Patterns Setup" menu and follow the instructions on the display.

## C. Differential Setup:

### 1. Choose Radio:

For systems with multiple radios or a differential correction receiver capable of multiple frequencies or stations, the operator can choose the desired Differential Correction source. There are three places in the software the operator can make this selection:

- a. Waiting for Differential

When the WAG Flagger 2000 is "Waiting for Differential" during the initial startup sequence, the operator can press "Setup" and make the desired selection.

1. For all differential sources other than satellite, simply press the number beside the desired frequency.
2. For those systems equipped with a satellite differential source, after pressing "Setup" the operator presses "1" and then enters the number of the desired station.

In both systems, after selecting the desired frequency or station, the system will return to the "Waiting for differential" screen.

- b. Ready to Work mode:

When the WAG Flagger 2000 is in the "Ready to Work" mode, follow the steps below:

1. Access the "Setup" menu;
2. Access the "Diff." (abbreviation of differential) menu;

3. Access the "Choose radio" function;
4. For all differential sources other than satellite, simply press the number beside the desired frequency.
5. For those systems equipped with a satellite differential source, after pressing "Setup" the operator presses "1" and then enters the number of the desired station.

In both systems, after selecting the desired frequency or station, the system will return to the "Ready to Work" or the "Working" mode.

- c. Working mode, (a.k.a. Swath mode):

The frequency can also be changed when the WAG Flagger 2000 is in the "Working" mode. Just follow the same steps as in the "Ready to Work" mode.

## 2. Disable Differential

### **CURRENT FAA REGULATIONS DO NOT ALLOW THE USE OF A GPS GUIDANCE SYSTEM FOR NAVIGATION.**

**NOTE:** The Approach <sup>TM</sup> Lightbar text will continue to show "No Navigation" until this function is completed.

When the Differential is disabled, the WAG Flagger 2000 will present several options. One is to save the latitude and longitude of the current location. Another is to enter the latitude and longitude of where the pilot wishes to go. The third option is to display the latitude and longitude of the current location. These options will be discussed later under "Latitude/Longitude." Still, a fourth option is to enter the Latitude and Longitude of the "A" point in the first swath.

The steps to disable the differential are as follows:

- a. Access the "Setup" menu;
- b. Access the "Diff" menu;
- c. Select "Disable Differential";
- d. Press "Backspace" and the WAG Flagger 2000 will return to the "Ready for Work" mode.

**NOTE: IF THE DIFFERENTIAL IS DISABLED, THE ONE METER ACCURACY CANNOT BE MAINTAINED.**

## 3. Enable Differential:

Use this function to enable the differential in the event the differential has been disabled. The steps for enabling differential are as follow:

- a. Access the "Setup" menu;
- b. Access the "Diff" menu;
- c. Select "Enable Differential" and the WAG Flagger 2000 will return to the "Ready for Work" mode.

**NOTE:** The WAG Flagger 2000 by default will always have the differential enabled when turned on or restarted.

**NOTE:** At this point, to access the following functions, the operator must select "More" in the "Setup" menu.

### ***D. Differential Age Cutoff:***

**NOTE:** This setting can affect the accuracy of the system significantly and should be used with caution. For those systems using the a portable base station, the Differential Age Cutoff should be set at 18. For those systems using U. S. Coast Guard Beacon as the differential correction, the Differential Age Cutoff should be set at 28. For those systems using satellite differential correction, the age should be set at 45 to 60.

The steps for this function are as follows:

1. Access the "Setup" menu;
2. Press "4", "More";
3. Access the "Diff. Age Cutoff" menu;
4. Enter the desired setting and press "Enter";
5. The system will advance to the "Differential Correction Age Warning" option. Press "Enter" to return to the "Ready to Work" mode.

### ***E. Differential Correction Age Warning:***

This function is used to program the WAG Flagger 2000 to warn the pilot the differential correction is about to exceed the "age limit", by default this is set for five seconds. That is, five seconds before the "No differential" message is displayed by the Approach™ Lightbar the LED's will start blinking. This function is automatically accessed after pressing "Enter" during the "Differential Age Cutoff" function. The system defaults to five seconds but a warning can go as high as thirty-three seconds. To change this value simply follow the steps in "Differential Age Cutoff" and enter the desired value in step "5". The WAG Flagger 2000 will return to the "Ready to Work" mode when "Enter" is pressed.

### ***F. Access Cutoff:***

The Access Cutoff is a code which determines how long the WAG Flagger 2000 will operate. The WAG Flagger 2000 will let the operator know when there are 72 hours or less before the system deactivates. You need not be concerned with this option. If it becomes necessary to use this feature, the WAG Flagger 2000 will provide the necessary instructions.

### **G. Control Pad Setup:**

This function is not used with the Flagger 2000.

### **H. Default Setup:**

Activating this function will restore the default values to the WAG Flagger 2000. Various parts of the memory can also be erased but WAG Corporation must be contacted to get the password which allows this feature to work. This helps to prevent the operator from erasing the memory by accident.

### **I. Magnetic Variation:**

The Magnetic Variation feature allows the operator to set the magnetic variation of the compass. When a Magnetic Variation has been entered, there will be a "M" displayed instead of the "0" next to the any information which utilizes the compass. This function is accessed by selecting "Magnetic Variation" in the Setup menu. Continue by following the instructions displayed.

### **J. Time:**

The time of day can be programmed in the WAG Flagger 2000. To access, select "Time" in the Setup menu and follow the instructions displayed on the Control Pad.

## **VII. Other keys:**

Before we discuss how the various patterns work, we first need to explain "Swath width", "Work Left", "Work Right" and all of the other functions which can be accessed when the system is in the "Ready to Work" mode.

### **A. Swath width:**

The "Swath width" is the width of the swath you are going to fly. Since this can change often, we made it very easy to access. To change the swath, simply press the "Swath width" key, enter the desired value, and press "Enter." The system will return to the "Ready to Work" mode.

**NOTE:** When operating the Parallel pattern, the "Swath Width" can be changed during the job.

### **B. Work Left and Work Right:**

The Control Pads have one key labeled "Work <---->." Whichever direction the arrow is pointing on the Control Pad tells the WAG Flagger 2000 where the field is with respect to your A/B line. For example, if the A/B line is set on the left end of a field, then the field will be on the right side of the A/B line. Thus, the arrow should be pointing to the

right (---->). To change the direction of the “arrow” press the “Work” key and the arrow will toggle change each time the key is pressed.

**NOTE:** The “A/B” line will be discussed with the various patterns.

### **C. Backspace:**

The “Backspace” key has two functions with the WAG Flagger 2000. One is the “backing up and erasing” of a number. This is only activated when a function has been accessed that requires the inputting of numbers. The other function is similar to the “Esc” key on a desktop computer. At any time, except as stated above, pressing the “Backspace” will cause the WAG Flagger 2000 to return to the “Ready to Work” or the “Working” mode. This allows the operator to exit a function he does not wish to alter. When “Backspace” is used to exit a particular function, the changes made while in the particular function will not be saved.

### **D. Latitude/Longitude (the “1” key)**

This function allows the operator to enter, save, retrieve or display latitudes and longitudes. The following explains how to use the various options. This function is accessed by pressing the “1” key which brings up the Lat/Lon menu:

**NOTE:** This function can also be accessed by disabling the differential in the “Differential Setup” menu.

#### 1. Entering latitude and longitude:

There are two ways to enter latitudes and longitudes. The most common is by entering the degrees. Another way is to enter the latitude and longitude in a decimal format. By default, the WAG Flagger 2000 assumes degrees will be used.

To enter a new latitude and longitude, follow these steps:

- a. Access the Lat/Lon menu;
- b. Select “Save”;
- c. Select “New Lat/Lon.”;
- d. Select the format of the latitude and longitude, degrees or decimal. The current format will be displayed at the top right in brackets, see below;

**B**

```
Latitude    [Deg.]  
1) North    2) South  
3) Use decimal form  
4) Use degrees;
```

- e. Select North or South;
- f. Enter the hour;
- f. Press “Enter” and enter the minutes;
- g. Press “Enter” and enter the seconds. If a decimal point is required when entering the seconds, press the “Swath Width” key;
- h. Press “Enter” and enter the Longitude following steps “a” through “g” above. In step “e”, the pilot will need to select East or West instead of North or South, the format will not have to be selected;
- i. When “Enter” is pressed after entering the seconds, the WAG Flagger

- 2000 will prompt the operator to enter a number under which to save the Lat/Lon;
- j. Enter the number and press "Enter".

**NOTE:** If the operator enters a Lat/Lon number that is already in use, the WAG Flagger 2000 will display the following:

```
This location is
already in use
1) Overwrite
2) Try another one
```

Select the desired option and proceed. **IF THE "OVERWRITE" OPTION IS CHOSEN THE PREVIOUS LATITUDE AND LONGITUDE WILL BE ERASED.**

When "Enter" is pressed at this point, the WAG Flagger 2000 will display the Heading, and Bearing to the particular latitude and longitude in miles carried out to the nearest tenth of a mile. See below for example:

```
179E           B180
```

Pressing the Flagger Switch or the "Enter" key will return the WAG Flagger 2000 to the "Ready to Work" mode. Pressing "6" repeatedly will display additional information.

**NOTE:** To enter a latitude and longitude in a decimal format, select "Decimal" in the Latitude menu and proceed as described above.

## **2. Saving current latitude and longitude:**

The steps to save the current location are as follows:

- a. Access the Save Lat/Lon menu and select "Current Position";
- b. Enter the location number to save the Lat/Lon under;
- c. Press Enter and the WAG Flagger 2000 will return to the "Ready to Work" mode;

## **3. Retrieving latitude and longitude:**

Access this function by selecting "Retrieve" in the Lat/Lon menu. Enter the location number of the latitude and longitude to be retrieved. When "Enter" is pressed after the location number is entered, the Control Pad will return to the "Ready to Work" screen, and the Heading and Bearing will be displayed on the Approach™ Lightbar text. Pressing the Flagger Switch will clear the Approach™ Lightbar text.

## **4. Displaying current latitude and longitude:**

To display the latitude and longitude of the present location, select "Display Current" in the "Save Lat/Lon" menu. Pressing any key other than "Backspace" at this point will freeze the display so the position can be written down.

## 5. Entering latitude and longitude for A/B/C points:

If you have a predefined field, you can enter the latitude and longitude of the A/B/C points on the Control Pad before taking off. At the WAIT A, WAIT B, or WAIT C screens, you can press "1" to access the "Lat/Lon" menu. A new option will appear as shown below:

```
Lat/Lon:
1) Save      2) Retrieve
3) Display Current
4) Enter A
```

**NOTE:** If the WAG Flagger 2000 II is at the "WAIT B" mode, the fourth option will be "Enter B", and "Enter C" will be the option if the WAG Flagger 2000 is at "WAIT C".

Choose "4" and you will be able to enter the latitudes and longitudes of an A, B and/or C point in a particular pattern. Using this method, you can define the field and then save it as a "Save Point/Pattern" without leaving the ground.

### ***E. Approach™ Lightbar ON/OFF (the "2" key)***

Pressing the "2" key toggles the Approach™ Lightbar ON and OFF.

### ***F. Previous (Backup) (the "3" key):***

This function enables the operator to backup to the previous swath or the A/B line if desired. Note the Approach™ Lightbar "flips" when you back up. Depending on where you are with respect to the field, you may have to press the "5/Flip" key to correctly orient yourself. Pressing the Flagger Switch again will advance to the next swath.

When the "Multiple Fields" feature is being used the "Previous" key works a little different. Suppose the pilot is flying multiple fields and the current pattern is parallel and the swath is #10. If "Previous" is pressed 3 times to go back to swath #7 to correct an earlier mistake and the Flagger Switch is pressed again, the WAG Flagger 2000 will advance to swath #11. This will keep the pilot in sync with the rest of the fields.

### ***G. Flip (the "5" key)***

This key "flips" the Approach™ Lightbar and allows the operator to reverse the swath direction. This keeps the pilot from having to fly to the other side of the field to resume the job after getting another load. When the Approach™ Lightbar is flipped, the letters "FP" will be indicated on the Control Pad, as shown below:

```
WAG Flagger 2000   V1.0
SW: 50           Df: 310.0
                  FP
Parallel         ---->>
```

## **H. *Scroll (the "6" key)***

This key displays additional information on the Approach™ Lightbar text and Control Pad. Additional information can be displayed when the WAG Flagger 2000 is in the Working, Save Point/Pattern, Lat/Lon, Homepoint and the Return to Field modes. Pressing the "Scroll" key will advance to the next group of information to be displayed. If the "Backspace" key is pressed, the system will return to the first group of information.

## **I. *Multiple Fields (the "7" key)***

The "Multiple Fields" feature is accessed by pressing this key. This feature is especially useful if there are a number of small fields near each other. Refer to "Flying Multiple Fields" for more details.

## **J. *Homepoint (the "8" key)***

The WAG Flagger 2000 allows the pilot to set up several "Homepoints", normally the runway strips, so he can make ferries more efficient. Refer to "Homepoint" for more details.

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## VIII. Operating:

### A. **Cross Track**

The Cross Track is the distance from the center of swath to the location of the aircraft. It is displayed on the Approach™ with the bottom three rows of LED's and on the alphanumeric on the right side.

The Approach™ can be “design” for “Aviation” which means the pilot flies the aircraft towards the LED's which are indicating the Cross Track. However, if when “designing” the Approach™ Lightbar the users selects “Ground”, then the aircraft is flown away for the direction the Cross Track LED's are indicating.

### B. **Intercept Angle**

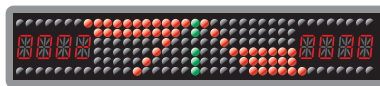
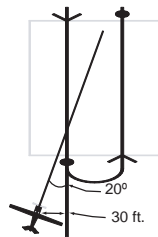
The Intercept Angle is the angle the aircraft is traveling with respect to the intended swath. It is displayed on the Approach™ Lightbar with the top two rows of LED's and indicates to the pilot which side of the intended swath the aircraft is on.

### C. **Examples:**

In all of the examples for simplicity's sake the Cross Track LED's are set to three foot intervals and the Intercept Angle LED's are set at two degree intervals.

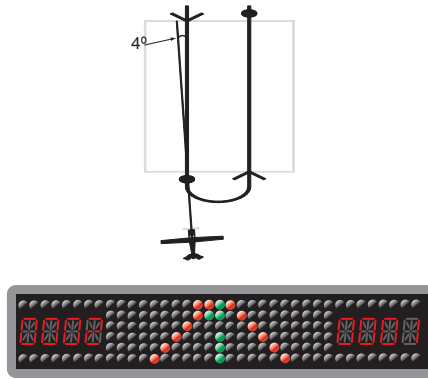
**NOTE:** The Cross Track and Intercept Angle LED's can be set to any value the operator desires.

1. The aircraft is approaching the intended swath from the left side. The Cross Track is thirty feet and the Intercept Angle is twenty degree angle;



Point 1:

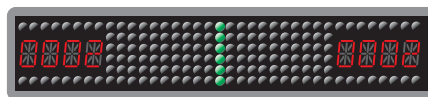
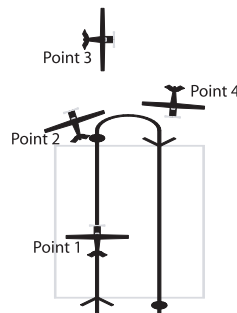
- a. Cross Track LED's - 10 LED's are ON, on the right side;
  - b. Cross Track alphanumeric - Right digital display - 0030
  - c. Intercept Angle LED's - 10 LED's are ON, on the left side;
  - d. Swath Count - 0002
2. The aircraft is on or very near to the center of the swath but traveling at a four degree angle on the left side of center.



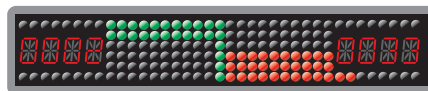
Point 1:

- a. Cross Track LED's - Only the center LED's are ON;
- b. Cross Track alphanumeric - 0001;
- c. Intercept Angle LED's - 2 LED's on the left side;
- d. Swath Count - 0002.

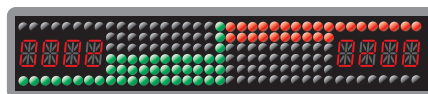
3. The aircraft is completing a swath and is advancing to the next swath:



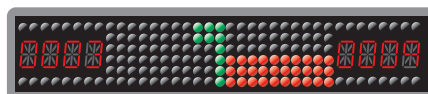
Point 1



Point 2



Point 3



Point 4

- Point 1: Aircraft is on the center of the swath:
- a. Cross Track LED's - Only the center LED's are ON;
  - b. Cross Track alphanumerics - 0002
  - c. Intercept Angle LED's - Only the center LED's are ON;
  - d. Swath count - 0002.

Point 2: Aircraft has completed the swath but has NOT advance to the next swath. The Cross Track is thirty feet and the Intercept Angle is eighteen degrees;

- a. Cross Track LED's - 11 LED's are ON, on the right side;
- b. Cross Track alphanumerics - 0033;
- c. Intercept Angle LED's - 9 LED's are ON, on the left side;
- d. Swath Count - 0002.

Point 3: The aircraft has advance to the next swath. The Cross Track is 200 feet and the Intercept Angle is ninety degrees;

- a. Cross Track LED's - All LED's are ON, on the left side;
- b. Cross Track alphanumerics - 0200;
- c. Intercept Angle LED's - All the LED's are ON, on the right side;
- d. Swath Count - 0003.

- Point 4:           The aircraft is approaching the intended swath. The Cross Track is twenty eight feet and the Intercept Angle is four degrees;
- a.       Cross Track LED's -               9 LED's are ON, on the right side;
  - b.       Cross Track alphanumerics -   0009;
  - c.       Intercept Angle LED's -       2 LED's are ON, on the left side;
  - d.       Swath Count -                    0003.

## VIII. Patterns:

The WAG Flagger 2000 has a total of fourteen different patterns with variations for many of the patterns, and can be combined to allow unlimited possibilities. All the patterns have an A/B line which must be established on the first pass of a field. Some of the patterns also have a "C" point which will be discussed with the respective patterns. The patterns also require the operator to set the "Swath Width" and the "Work Left/Work Right" direction. See the previous discussion on "Swath Width" and "Work Left/Work Right".

### A. *Parallel:*

The Parallel pattern is also known as "Back and Forth." It is a pattern that guides the operator back and forth across a field with each swath being parallel to the previous one. Since this is the most common pattern used, the WAG Flagger 2000 defaults to this pattern upon startup.

Steps for "Parallel". Refer to Figure 1 for a diagram of this pattern:

1.       Set the Swath Width;
2.       Set the Work direction;
3.       After entering the field on the first pass, press the "Flagger Switch", which is referred to as a "dot" in all Figures, to set the "A" point of the A/B line. When "Flagger Switch" is pressed, the Approach Lightbar will strobe and the Approach Lightbar text will show "WAIT B";

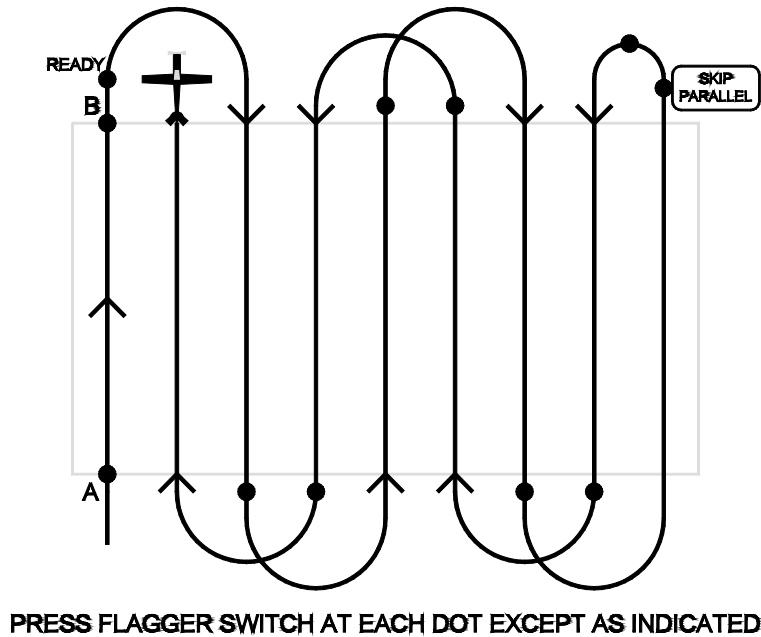
**NOTE:** After pressing the "Flagger Switch", the WAG Flagger 2000 will display the distance traveled from the "A" point until the "B" point is set. This is displayed on the left end of the Approach™ Lightbar text.

4.       Before exiting the field on the first pass, press the "Flagger Switch" again to set the "B" point of the A/B line. The Approach™ Lightbar will strobe again and the lightbar text will read "OK";
5.       Press the "Flagger Switch" again while making the turn to start the second pass. Then simply steer in the direction of the light until the center lights are ON. The Approach™ Lightbar text will display the Swath count and the Cross Track.
6.       After each swath, press the "Flagger Switch" to advance to the next pass.

**NOTE:** It is not necessary to use the "Save Point/Pattern" function when leaving the field to get another load. However, if the operator is not returning to the job until some time later, the Save Point/Pattern feature should be used. Refer to "Save Point/Pattern" for additional information.



**NOTE:** All of the odd number swaths are completed when the end of the field is reached.



**Figure 2. Reverse Skip Parallel**

## **2. Go to 2<sup>nd</sup> Swath:**

Steps for "Go to 2<sup>nd</sup> Swath Skip Parallel". Refer to Figure 3 for a diagram of this pattern:

- a. Set the Swath Width;
- b. Set the Work Direction;
- c. Press "Skip Parallel" to access the "Skip Parallel Menu";
- d. Select "Go to 2<sup>nd</sup> Swath";
- e. Follow steps 3 thru 6 in "Parallel" above;

**NOTE:** The "second" pass in step "5" of "Parallel" is actually the third swath in "Skip Parallel."

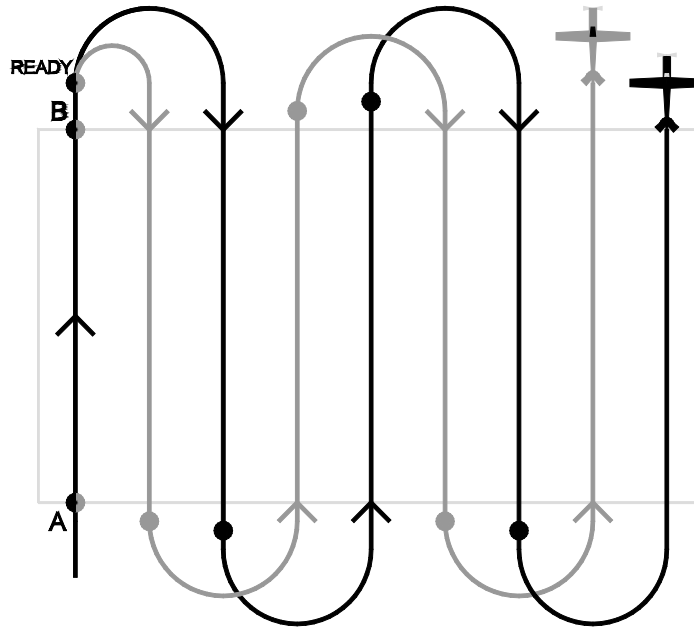
- f. When the last odd number swath has been completed, the operator presses "Skip Parallel" and then the "Flagger Switch." The WAG Flagger 2000 will guide the operator back to the other side of the field to the "2<sup>nd</sup>" swath. Continue the job until there is not enough space for another swath.

**NOTE:** All of the odd number swaths are completed when the end of the field is reached.



Steps for "Tandem Parallel". Refer to Figure 4 for a diagram of this pattern:

- a. Set the Swath Width;
- b. Set the "Work Direction";
- c. Access the "Tandem Parallel" Menu by pressing "Tandem Parallel";
- d. Select the appropriate "Pilot" designation, either First Pilot or Second Pilot;
- e. Follow steps 3 thru 6 of "Parallel Patten". Refer to Figure 4 for a diagram of this pattern.



**PRESS FLAGGER SWITCH AT EACH DOT**

**Figure 4. Tandem Parallel, Same Swath**

2. Both planes flying different size swaths:

With this pattern, two planes with different size swaths can work the same field. These two Tandem Parallel patterns differ in that after the pilot selects which pilot designation his aircraft will be, he will enter the swath width of the other aircraft.

**NOTE:** The steps to program the WAG Flagger 2000 to fly a "Tandem Parallel" with different size swaths are:

1. Access the "Setup" menu;
2. Access the "Tandem Parallel" menu;
3. Select "1 & 2 swath diff".

- a. First Pilot:

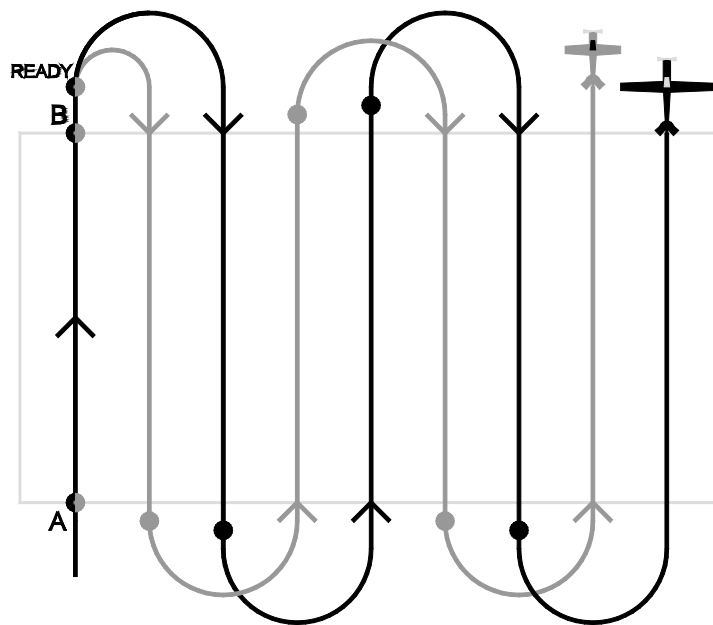
The First Pilot in this pattern flies the same pattern as if he were flying in "Tandem Parallel, Same Size Swath". The only difference is the Swath Width of the other aircraft must be entered.

b. Second pilot:

The second pilot flies the same pattern as the “second pilot in “Tandem Parallel, Same Size Swath”. The only difference is the Swath Width of the other aircraft must also be entered.

Steps for “Tandem Parallel with different size swaths. Refer to Figure 5 for a diagram of this pattern:

1. Set the Swath Width;
2. Set the Work Direction;
3. Access the “Tandem Parallel” menu by pressing “Tandem Parallel”;
4. Select the appropriate “Pilot” designation;
5. Enter the Swath Width of the other aircraft;
6. Continue with steps 3 through 6 of the “Parallel Pattern”.



**PRESS FLAGGER SWITCH AT EACH DOT**

**Figure 5. Tandem Parallel, Different Swaths**

**D. Racetrack:**

The WAG Flagger 2000 has a total of four different “Racetrack” patterns. The Racetrack patterns require the pilot to establish a “C” point as well as an A/B point. The “C” point merely allows the WAG Flagger 2000 to determine where the center of the pattern will be for the particular Racetrack pattern. The following is a discussion of the various Racetrack patterns.

**NOTE:** With those patterns which have a “C” point, the “Swath Count” first displays the total swaths in the job and counts down as the job progresses. This will be useful for when the “Continue Pattern” function is used. This occurs on the Approach™ Lightbar text.

## 1. Computed Racetrack:

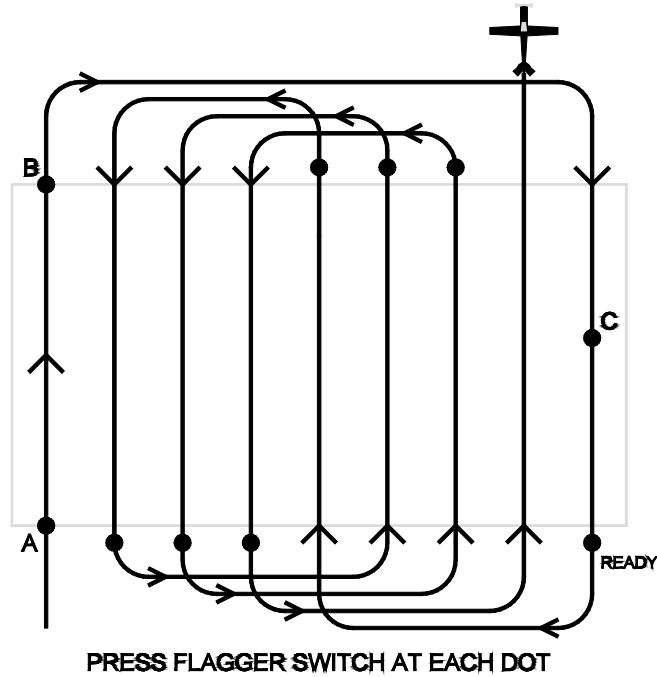
Computed Racetrack is the pattern which calculates the center of the field and offsets it so if there is an overspray on a particular pass, it will always be on the last pass next to the “C” line. Computed Racetrack optimizes the flight time of the aircraft by reducing the time spent flying from one side of the field to the other establishing the “A”, “B” and “C” points. It accomplishes this by spraying the swath in the center of the field first after the C pass, rather than flying back to the A/B end of the field to start the job.

Steps for “Computed Racetrack”. Refer to Figure 6 for a diagram of this pattern:

- a. Set the Swath Width;
- b. Set the Work Direction;
- c. Access “Racetrack” menu by pressing “Racetrack”;
- d. Select “Computed Racetrack”;
- e. Set the A/B line the same as in the other patterns. After setting the “B” point the distance between the A and B points will remain on the Approach™ Lightbar text and “WAIT C” will also be displayed;
- f. Fly to the other end of the field and spray the last pass on that end. While spraying the last pass, press the Flagger Switch to establish the “C” point. The WAG Flagger 2000 will be displaying the distance the plane is traveling from the A/B Line to the point where the “C” point is set on the right end of the Approach™ Lightbar text. The pilot can now estimate the size of the field with these measurements;
- g. Once the “C” pass is completed, press the “Flagger Switch” again and the WAG Flagger 2000 will guide the pilot to the center of the field. Then simply steer in the direction of the light until the center lights are on. The Approach™ Lightbar text will show the Swath count and the Cross Track;
- h. After completing this pass, press the “Flagger Switch” and the WAG Flagger 2000 will guide the pilot to the pass next to the “center pass. This pass is on the side of the center pass which is opposite the A/B line side;
- i. After each pass press the “Flagger Switch” to advance the to the next pass.
- j. The field is finished when the Swath Count reads all “0's”.

**NOTE:** There will be times when the last swath appears to be the same as the “C” pass. This is due to the fact the WAG Flagger 2000 will calculate another swath if there is an area greater than one foot wide that has not been treated.

**NOTE:** If there is any over spray due to the size of the field, this will always occur on the last pass.



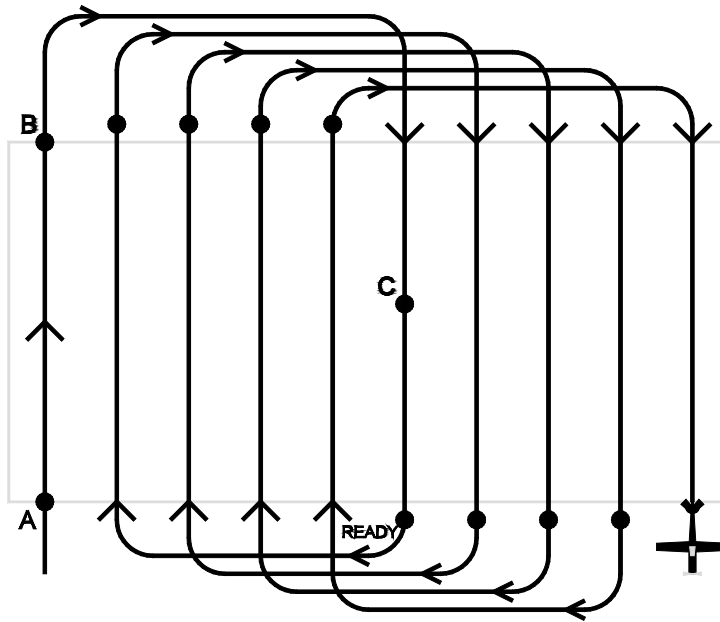
**Figure 6. Computed Racetrack**

## 2. Estimated Racetrack:

Estimated Racetrack is the pattern the pilot uses when he wishes to "estimate" the center of the field. It works just like Computed Racetrack except the "C" point is set where the pilot "estimates" the middle pass of the field to be, instead of the last pass in the field.

Steps for "Estimated Racetrack". Refer to Figure 7 for a diagram of this pattern:

- a. Set the Swath Width;
- b. Set the Work Direction;
- c. Access "Racetrack" menu by pressing "Racetrack";
- d. Select "Estimated Racetrack";
- e. Set the A/B line the same as in the other patterns. After setting the "B" point the distance between the A and B points will remain on the Approach™ Lightbar text, and "WAIT C" also will be displayed;
- f. Fly to the "estimated" center of the field and spray this pass. While spraying the this pass, press the Flagger Switch to establish the "C" point. The WAG Flagger 2000 will be displaying on the right end of the Approach™ Lightbar text the distance the plane is traveling from the A/B Line to the point where the "C" point is set;
- g. Once the "C" pass is completed, press the "Flagger Switch" again and the WAG Flagger 2000 will guide the pilot to the pass next to the A/B line;
- h. After completing this pass, press the "Flagger Switch" and the WAG Flagger 2000 will guide the pilot to the pass next to the "C" pass. This pass is on the side of the "C" pass that is opposite the A/B line side;
- i. The field is finished when the Swath Count reads all "0's".



PRESS FLAGGER SWITCH AT EACH DOT

Figure 7. Estimated Racetrack

### 3. Racetrack

A

“Racetrack” is a different pattern that WAG has developed to accommodate users of other GPS systems. It is a racetrack pattern that is set up exactly like “Computed Racetrack”. Except that after the “C” pass, the pilot must fly back to the other end of the field, the A/B line end, to start the job.

Steps for “Racetrack”. Refer to Figure 8 for a diagram of this pattern:

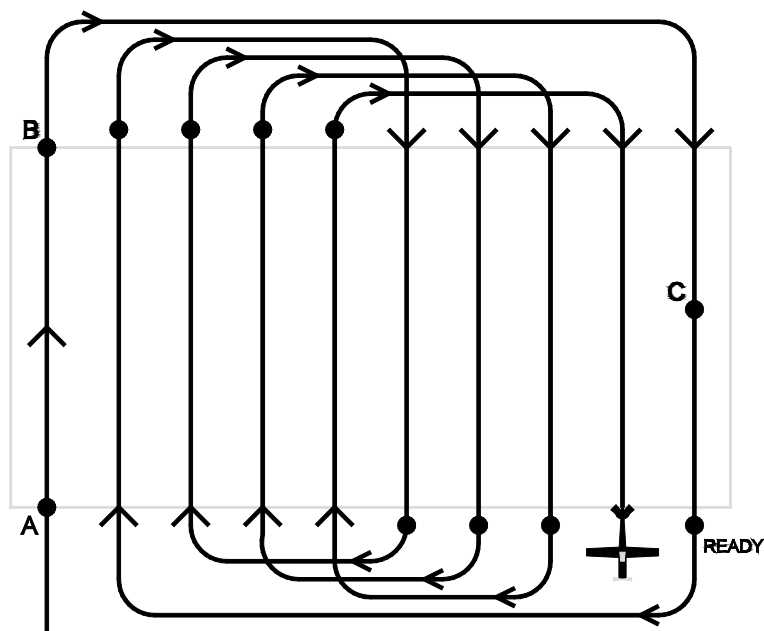
- a. Set the Swath Width;
- b. Set the Work Direction;
- c. Access the Racetrack menu by pressing “Racetrack”;
- d. Press “4” to scroll the menu and then select “Racetrack”;
- e. Set the A/B line the same as in the other patterns. After setting the “B” point, the distance between the A and B points will remain on the Approach™ Lightbar text and “WAIT C” will also be displayed;
- f. Fly to the other end of the field and spray the last pass at that end. While spraying the last pass, press the Flagger Switch to establish the “C” point. The WAG Flagger 2000 will be displaying on the right end of the Approach™ Lightbar text the distance the plane is traveling from the A/B Line to where the “C” point is set. After the “C” point is set, the pilot can estimate the size of the field;
- g. Once the “C” pass is completed, press the “Flagger Switch” again and the WAG Flagger 2000 will guide the pilot to the A/B end of the field. This pass is next to the A/B line but on the side opposite the “C” pass. Then simply steer in the direction of the light until the center lights are ON. The Approach™ Lightbar text will display the Swath count and the Cross Track;

**NOTE:** The Swath Count first displays the total swaths in the job and counts down as the job progresses.

- h. After completing this pass, press the “Flagger Switch” and the WAG Flagger 2000 will guide the pilot to the pass next to the “C” pass. This pass is on the side of the “C” pass which is on the same side as the A/B line;
- i. After each pass, press the “Flagger Switch” to advance the to the next pass;
- j. The field is finished when the Swath Count reads all “0's”.

**NOTE:** There will be times when the last swath appears to be the same as the “C” pass. This is due to the fact that the WAG Flagger 2000 will calculate another swath if there is an area greater than one foot that has not been treated.

**NOTE:** If there is any overspray due to the size of the field, this will always occur on the last pass.



**PRESS FLAGGER SWITCH AT EACH DOT**

**Figure 8. Racetrack**

#### 4. Center Pivot:

The "Center Pivot" pattern gets its name for the field it was designed for. That is a field which has a center pivot irrigation system. The intent is to allow the pilot to establish the A/B line on the longest possible pass, thus using the most chemicals on the first pass. After the A/B line is established, the pilot then sets the "C" point on the end of the field which is in the direction he wishes fly.

Steps for "Center Pivot". Refer to Figure 9 for a diagram of this pattern:

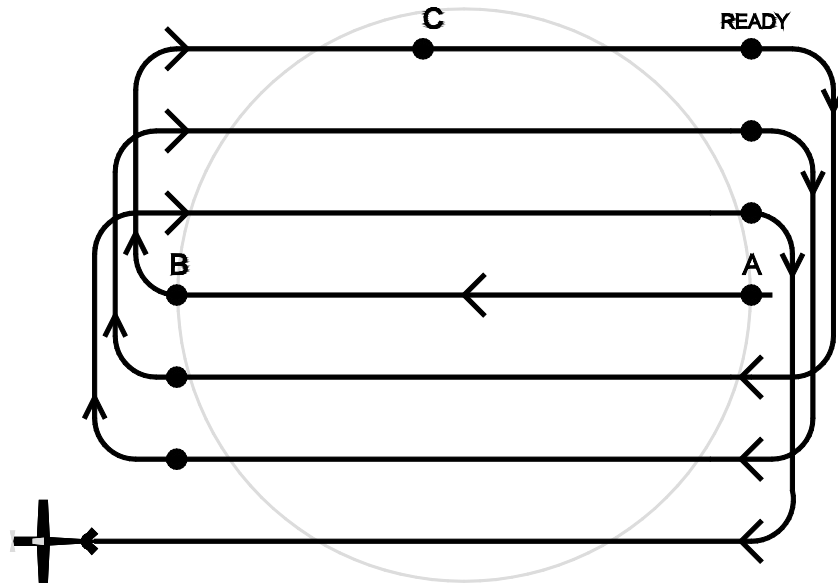
- a. Set the Swath Width;
- b. Set the Work Direction;
- c. Access Racetrack menu by pressing "Racetrack";
- d. Press "4" to scroll menu then select "Center Pivot";
  - e. Set the A/B line on the pass that is in the center of the field. After setting the "B" point the distance between the A and B points will remain on the Approach™ Lightbar text and "WAIT C" will also be displayed;
  - f. Fly to the other end of the field which in the same direction as established with the "Work Direction" and spray the last pass on that end. While spraying this pass, press the Flagger Switch to establish the "C" point. The WAG Flagger 2000 will be displaying on the right end of the Approach™ Lightbar text the distance the plane is traveling from the A/B Line to where the "C" point set;
  - g. Once the "C" pass is completed, press the "Flagger Switch" again and the WAG Flagger 2000 will guide the pilot to the pass which is next to the A/B line. Then simply steer in the direction of the light until the center lights are ON. The Approach Lightbar text will display the Swath count and the Cross Track;

**NOTE:** As in other Racetrack patterns, the Swath Count first displays the total swaths in the job and counts down as the job progresses.

- h. After completing this pass, press the "Flagger Switch" and the WAG Flagger 2000 will guide the pilot to the pass next to the "C" pass. This pass is on the same side as the A/B line;
- i. After each pass, press the "Flagger Switch" to advance to the next pass;
- j. The field is finished when the Swath Count reads all "0's".

**NOTE:** There will be times when the last swath appears to be the same as the "C" pass. This is due to the fact the WAG Flagger 2000 will calculate another swath if there is an area greater than one foot wide that has not been treated.

**NOTE:** If there is any overspray due to the size of the field, this will always occur on the last pass.



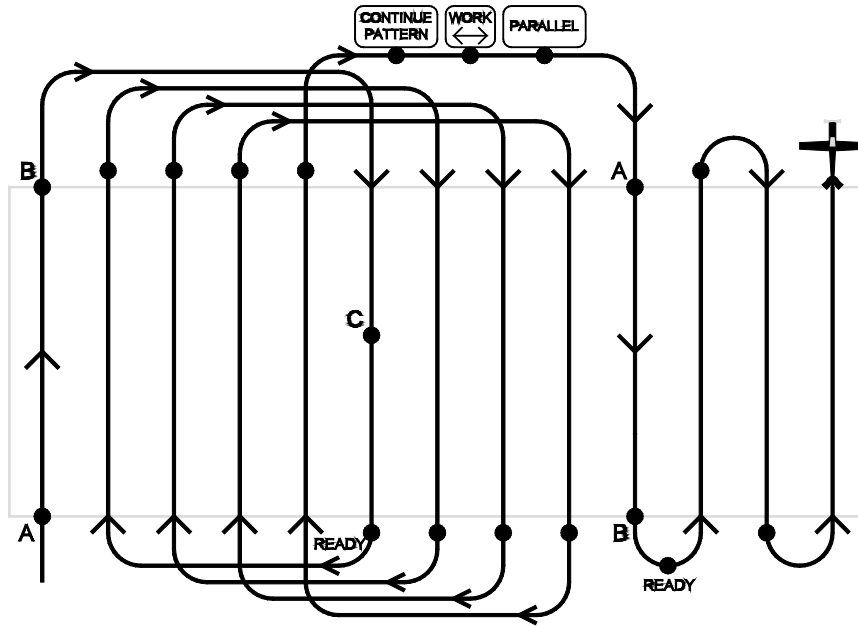
**PRESS FLAGGER SWITCH AT EACH DOT**

**Figure 9. Center Pivot Racetrack**

**E. Continue Pattern:**

The Continue Pattern is a function which allows the pilot to set up another pattern which is parallel to the A/B line of the previous pattern. This function is often used to divide a large field into several patterns, such as Estimated Racetrack, or to complete a portion of a field which was not covered by a previous pattern. Examples of when Continue Pattern could be used are:

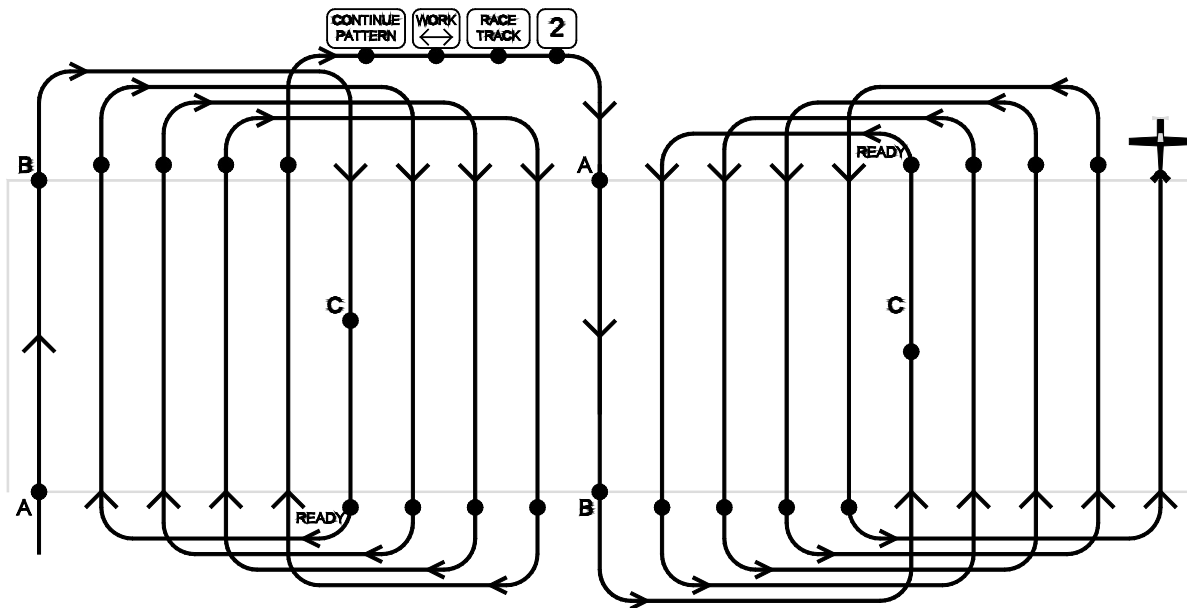
1. When using Estimated Racetrack, it is very difficult to estimate the center of the field. When the swath count is zero and there is still a portion of the field which has not been treated, the pilot can complete it by using Continue Pattern and set up a Parallel pattern. Refer to Figure 10 for a diagram of this pattern;



PRESS FLAGGER SWITCH AT EACH DOT EXCEPT AS INDICATED

Figure 10. Continue Pattern with Parallel

- Another example is dividing a large field into several Estimated Racetrack patterns, thus avoiding large, time consuming turns. Refer to Figure 11 for a diagram of this pattern.



PRESS FLAGGER SWITCH AT EACH DOT EXCEPT AS INDICATED

Figure 11. Continue Pattern with two Estimated Racetracks

Steps for "Continue Pattern":

- a. Complete the existing pattern until the "Swath Count" equals "0";
- b. Press "Continue Pattern";
- c. Select the desired pattern. At this point, the Approach™ Lightbar text will read "WAIT A", **but the Approach™ Lightbar will still be providing guidance for this swath;**
- d. Set the Work Direction;
- e. Set the A/B points while flying this swath using the Approach™ Lightbar for guidance. The guidance from the Approach™ Lightbar will allow the pilot to set this A/B line parallel with the original A/B line;

**NOTE:** Once the "B" point is set, the guidance from the Approach™ Lightbar is discontinued for that swath. Therefore, you should set the "B" point close to the end of the swath.

- f. After setting the "B" point, the pattern enters its normal operation mode. Continue with the pattern as described above.

## ***F. Tandem Racetrack:***

Tandem Racetrack allows two planes to fly a Racetrack pattern in the same field. With Tandem Racetrack, the pilots will fly alternating swaths and the First Pilot will always fly on the downwind side of the second pilot. As with Tandem Parallel, there are two different types of Tandem Racetrack, 1) both planes with the same size swath and 2) each plane using a different size swath. The choice of patterns is made in "Patterns Setup" mode. This eliminates the need for the pilots to answer several questions before they fly the pattern. The following is a description of the two methods.

**NOTE:** The 2<sup>nd</sup> pilot is to spray the A/B and C swaths to avoid flying in the spray of the 1<sup>st</sup> pilot.

1. Both planes flying the same swath

- a. First Pilot

Both pilots set the A/B and C lines on the same swaths as in "Computed Racetrack". However, with this pattern the 2<sup>nd</sup> pilot sprays the A/B and C swaths, thus avoiding the spray of the First Pilot. After the 1<sup>st</sup> pilot sets the "C" line, the WAG Flagger 2000 guides the 1<sup>st</sup> pilot to the swath in the center of the field, as in "Computed Racetrack", and then guides him to the swath next to the A/B line. The 1<sup>st</sup> pilot flies the rest of the field spraying only the "even" numbered swaths.

- b. Second pilot

The 2<sup>nd</sup> pilot sets his A/B and C lines on the same swaths as the 1<sup>st</sup> pilot except the 2<sup>nd</sup> pilot sprays A/B and C swaths. After the 2<sup>nd</sup> pilot sprays the "C" swath, the WAG Flagger 2000 will guide him to the swath which is next to the swath in the center of the field. This swath is on the "C" side of the center swath. Next, the WAG Flagger 2000 will guide the 2<sup>nd</sup> pilot to the third swath on the A/B side of the field. The pilot then flies the field in a racetrack pattern spraying only the "odd" numbered swaths.

Steps for “Tandem Racetrack Same Swath”. Refer to Figure 12 for a diagram:

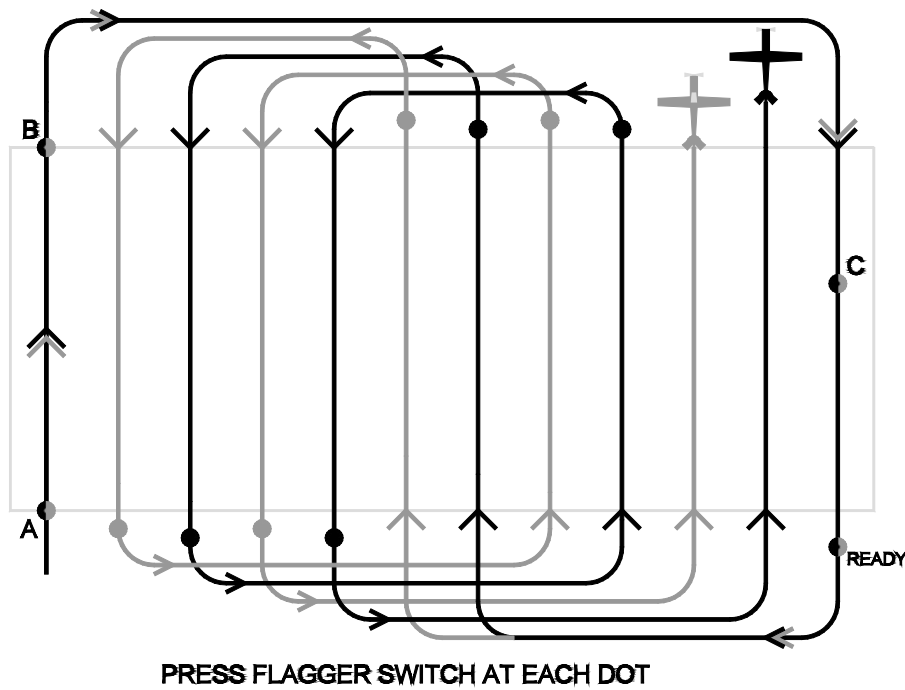
a. First Pilot

1. Set the Swath Width;
2. Set the Work Direction;
3. Access Tandem Racetrack menu;
4. Select 1<sup>st</sup> pilot designation;
5. Set “A” and “B” points on the first pass;
6. Set the “C” point on the last pass at the other end of the field;
7. Once the “C” pass is completed, press the “Flagger Switch” again and the WAG Flagger 2000 will guide the First Pilot to the center of the field. Then simply steer in the direction of the light until the center lights are ON. The Approach™ Lightbar text will display the Swath count and the Cross Track;
8. After each pass, press the “Flagger Switch” to advance to the next swath;
9. The next pass the First Pilot sprays, is the swath next to the A/B line;
10. The First Pilot flies the field spraying the “even” numbered swaths;
11. The field is finished when the Swath Count reads all “0's”.

b. Second Pilot

1. Set the Swath Width;
2. Set the Work Direction;
3. Access Tandem Racetrack menu;
4. Select 2<sup>nd</sup> pilot designation;
5. Set “A” and “B” points on the first pass and spray this swath;
6. Set the “C” point on the last pass at the other end of the field and spray this swath;
7. Once the “C” pass is completed, press the “Flagger Switch” again and the WAG Flagger 2000 will guide the Second Pilot to the swath which is next to the center swath. This swath is on the same side of the center swath that the “C” point is on. Then simply steer in the direction of the light until the center lights are ON. The Approach™ Lightbar text will display the Swath count and the Cross Track;
8. After each pass, press the “Flagger Switch” to advance to the next swath;
9. The next pass the Second Pilot sprays is the third swath on the A/B end of the field;

10. The Second Pilot flies the field spraying the “odd” numbered swaths;



**Figure 12. Tandem Racetrack, Same Swaths**

2. Both planes flying different swaths

This pattern is the same as "Tandem Racetrack with both planes flying same swaths", except the planes have different swaths.

**NOTE:** The aircraft with the larger swath must fly this pattern as the 2<sup>nd</sup> pilot, and also spray the A/B and C swaths.

- a. First Pilot

The First Pilot flies this pattern exactly the same as in the previous Tandem Racetrack. The only difference is in setting the pattern up, the pilot must enter the swath width of the Second pilot.

- b. Second Pilot

The Second pilot also flies this the patten the same as in the previous Tandem Racetrack. The only difference is in setting the pattern up, the pilot must enter the swath width of the First Pilot.

Steps for "Tandem Racetrack Different Swaths". Refer to Figure 13 for a diagram:

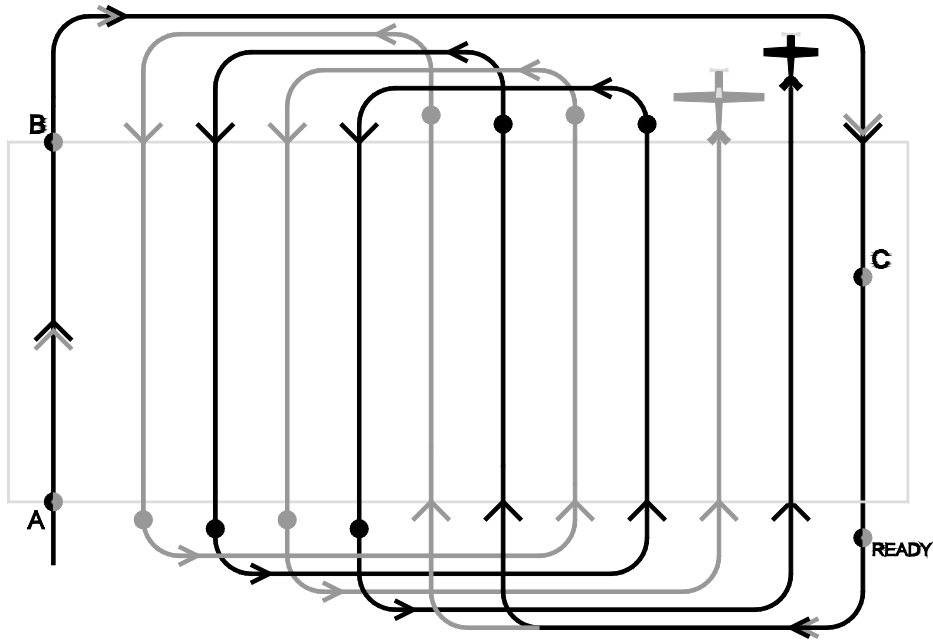
- a. First Pilot

1. Set the Swath Width;
2. Set the Work Direction;
3. Access Tandem Racetrack menu;

4. Select 1<sup>st</sup> pilot designation;
5. Set the Swath Width of the other aircraft;
6. Set "A" and "B" points on the first pass;
7. Set the "C" point on the last pass at the other end of the field;
8. Once the "C" pass is completed, press the "Flagger Switch" again and the WAG Flagger 2000 will guide the First Pilot to the center of the field. Then simply steer in the direction of the light until the center lights are ON. The Approach <sup>TM</sup> Lightbar text will display the Swath count and the Cross Track;
9. After each pass, press the "Flagger Switch" to advance to the next swath;
10. The next pass the First Pilot sprays is the swath next to the A/B line;
11. The First Pilot flies the field spraying the "even" numbered swaths;
12. The field is finished when the Swath Count reads all "0's".

b. Second Pilot

1. Set the Swath Width;
2. Set the Work Direction;
3. Access Tandem Racetrack menu;
4. Select 2<sup>nd</sup> pilot designation;
5. Set the Swath Width of the other aircraft;
6. Set "A" and "B" points on the first pass and spray this swath;
7. Set the "C" point on the last pass at the other end of the field and spray this swath;
8. Once the "C" pass is completed, press the "Flagger Switch" again and the WAG Flagger 2000 will guide the Second Pilot to the swath which is next to the center swath. This swath is on the same side of the center swath that the "C" point is on. Then simply steer in the direction of the light until the center lights are ON. The Approach <sup>TM</sup> Lightbar text display the Swath count and the Cross Track;
9. After each pass, press the "Flagger Switch" to advance to the next swath;
10. The next pass the Second Pilot sprays is the swath which is the third swath on the A/B end of the field;
11. The Second Pilot flies the field spraying the "odd" numbered swaths;
12. The field is finished when the Swath Count reads all "0's".



**PRESS FLAGGER SWITCH AT EACH DOT**

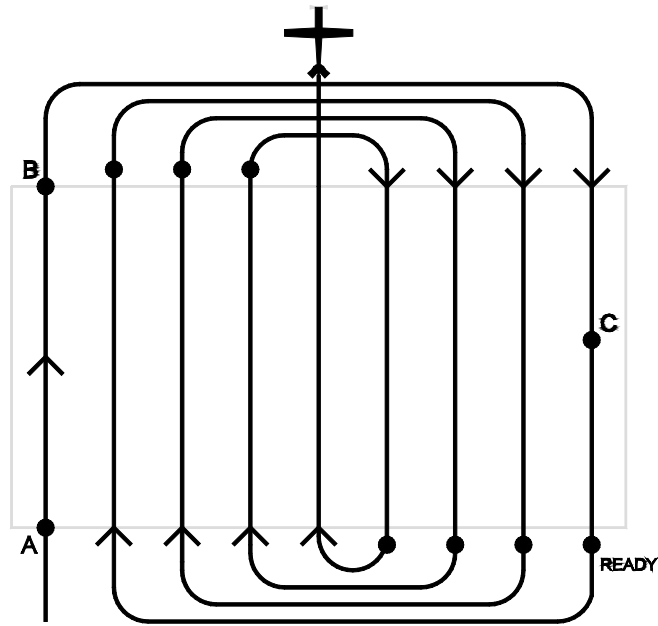
**Figure 13. Tandem Racetrack, Different Swaths**

### **G. Squeeze:**

Squeeze is a pattern that works from the edges of a field to the center. This pattern is ideal for treating a field that can be sprayed in one load, which allows the pilot to make the big turns when he has the greatest load. The pilot sets the A/B and C lines just like in Computed Racetrack. Also, like the other Racetrack patterns, the Approach™ Lightbar text shows the distance between the points. The swath counter will show the total number of passes in the field and count down to "0".

Steps for Squeeze. Refer to Figure 14 for a diagram of this pattern:

1. Set the Swath Width;
2. Set the Work Direction;
3. Access the Squeeze pattern;
4. Set A/B points on the first pass and spray this swath;
5. Set the "C" point on the last pass at the other end of the field and spray this swath;
6. Once the "C" pass is completed, press the "Flagger Switch" again and the WAG Flagger 2000 will guide the pilot to the swath at the other end of the field next to the A/B Line. Then simply steer in the direction of the light until the center lights are ON. The Approach™ Lightbar will display the Swath count and the Cross Track;
7. After this pass is completed press the "Flagger Switch" and the WAG Flagger 2000 will guide the pilot back to the other end of the field to the swath next to the "C" swath;
8. Continue pressing the "Flagger Switch" after each pass to advance to the next pass;
9. The field is finished when the Swath Count reads all "0's".



PRESS FLAGGER SWITCH AT EACH DOT

Figure 14. Squeeze

## H. Multiple fields:

The WAG Flagger 2000 supports flying multiple fields simultaneously using different patterns in each field, depending on the patterns the pilot uses. In scenarios where there are a number of small fields near each other, this eliminates the small turns and provides more efficient use of fuel and chemicals. The pilot also has the option of selecting the sequence the fields will be flown; Either the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> fields, then back to the 1<sup>st</sup> field, then the 2<sup>nd</sup> and 3<sup>rd</sup> etc., or 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> fields then 3<sup>rd</sup>, 2<sup>nd</sup> and 1<sup>st</sup> fields.

**NOTE:** The pilot should select a sequence of patterns which allows for the most efficient use of the multiple fields feature.

Steps for "Multiple Fields". Refer to Figure 15 and 16 for diagrams of this pattern:

1. Set the Swath Width;
2. Access Multiple Fields;
3. Enter the number of fields involved. A maximum of three can be used;
4. Enter the Flight Sequence;
5. Select the first pattern;
6. Set the Work Direction of the first pattern;
7. Select the second pattern;
8. Set the Work Direction of the second pattern;
9. Select the third pattern, if three fields are selected;
10. Set the Work Direction of the third pattern;
11. Set the A/B line on the first pass of the first field;

**NOTE:** The Approach™ Lightbar text disguise the various “A,” “B” and “C” points of each pattern by displaying a number after each letter which represents the field number the point relates to. An example is the “A” in the first field is displayed as “A1” and the “B” in the third field is displayed as “B3”.

12. Set the A/B line on the first pass of the second field;
13. The WAG Flagger 2000 will automatically advance to the swath in the next field each time the Flagger Switch is pressed;
14. Continue until the fields are completed.

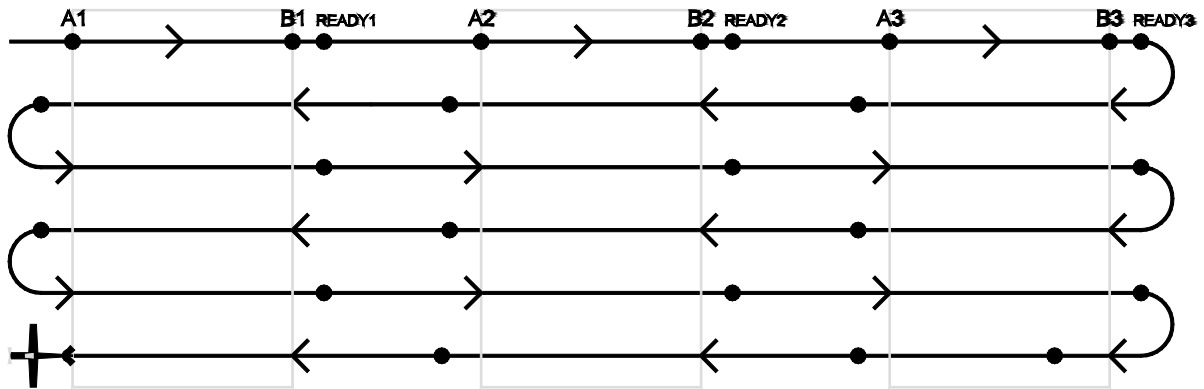
**NOTE:** Pressing the Flagger Switch will set the “A” point for the first field, and the program will advance to "WAIT B1". For programs that only have A-B points, pressing the Flagger Switch again will advance to "READY1." For patterns that have a C point, such as Racetrack and Squeeze, the program advances to the next field at this point.

For example, here are the sequences for three fields using three Parallel patterns and the sequence of 1-2-3 to 3-2-1 (the pilot should press the Flagger Switch at the end of each line). Refer to Figure 15 for a diagram of this pattern:

WAIT A1	-> Parallel, Field #1	(start with sequence 1-2-3)
WAIT B1	-> Parallel, Field #1	
READY1	-> Parallel, Field #1	
WAIT A2	-> Parallel, Field #2	
WAIT B2	-> Parallel, Field #2	
READY2	-> Parallel, Field #2	
WAIT A3	-> Parallel, Field #3	
WAIT B3	-> Parallel, Field #3	
READY3	-> Parallel, Field #3	(here the sequence changes to 3-2-1)
PASS #1	-> Parallel, Field #3	(first pass of the third field starts)
PASS #1	-> Parallel, Field #2	(first pass of the second field starts)
PASS #1	-> Parallel, Field #1	(first pass of the first field starts)
PASS #2	-> Parallel, Field #1	(here the sequence changes to 1-2-3) (second pass of the first field)
PASS #2	-> Parallel, Field #2	(second pass of the second field)
PASS #2	-> Parallel, Field #3	(second pass of the third field)
ETC.		

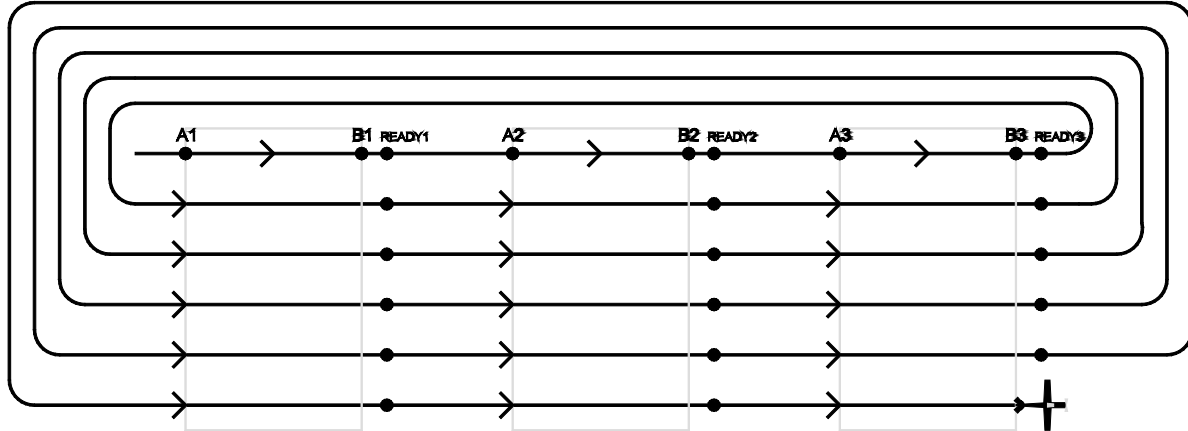
If the pilot chose sequence 1-2-3 to 1-2-3, then the sequence would never reverse and the fields would be flown in this order:

1-2-3-1-2-3-1-2-3-1-2-3...



PRESS FLAGGER SWITCH AT EACH DOT

Figure 15. Multiple Fields, 123-321 Sequence with Parallel Patterns



PRESS FLAGGER SWITCH AT EACH DOT

Figure 16. Multiple Fields, 123-123 Sequence with Parallel Patterns

## X. Save Point/Pattern:

The WAG Flagger 2000 has 700 "Save Point/Patterns" which save and store the current job in progress. Each Save Point/Pattern saves the swath count, swath width, current swath, pattern,

current position of the plane and the entire configuration of the system. The Save Point/Pattern is used when the pilot has to stop treatment of the field before it is finished, or to return to the point in the swath where his load ran out.

## **A. Saving a Save Point/Pattern:**

### **1. Saving a job**

Save Point/Pattern can be used to store and save a job that is incomplete and must be finished at a later time. For example, the wind may start to blow too hard, or the operator might have equipment problems that require the him to stop the application.

Steps for saving a job:

- a. Access "Save Point/Pattern" menu;

**NOTE:** When the "Save Point/Pattern" menu is accessed the function of the Flagger Switch is redefined. Pressing the Flagger Switch after the Save Point/Pattern menu is accessed is equivalent to pressing the "1" key which saves the job.

**NOTE:** The WAG Flagger 2000's that are configured for Helicopters have a second switch, similar to the Flagger Switch, which can also access the Save Point/Pattern menu when pressed.

- b. Press the "1" key or the Flagger Switch to save the job;
- c. Enter the desired "Save Point/Pattern" number the job will be saved under;
- d. Press "Enter" and the WAG Flagger 2000 will return to the "Work" or "Ready to Work" mode.

### **2. Saving a point in a swath**

The Save Point/Pattern function can also be used to save, or mark, a particular point in a swath where the chemicals ran out. This allows the pilot to return to the particular point in the swath and start the application again after reloading.

**NOTE:** Remember, the WAG Flagger 2000 is designed to avoid the pilot having to look at the Control Pad while actually applying the load.

The WAG Flagger 2000 assumes that the pilot knows if he will run out of chemical prior to spraying a particular swath. Thus, the pilot should access the "Save Point/Pattern" before entering the field to avoid having to look a the Control Pad while flying.

Steps for saving a point in a swath:

- a. Advance to the swath that needs to be saved;
- b. Access the Save Point/Pattern menu;
- c. Continue applying the chemicals on the swath;
- d. Press the Flagger Switch when the chemicals run out;

**NOTE:** Since Helicopter pilots may not have prior warning that they will run out of chemicals on any given swath, he must press the "Save Point/Pattern Switch" and then press the Flagger Switch to save the point when the chemicals actually run out.

- e. While ferrying back to the loading pad, enter the desired "Save Point/Pattern" number the job is to be saved under;
- f. Press "Enter" and the job will be saved and the WAG Flagger 2000 will return to the "Work" or "Ready to Work" Mode.

## **B. Retrieving Save Point/Pattern:**

### **1. Retrieving a job**

This function is used to retrieve a job that was incomplete.

Steps for retrieving a job:

- a. While reloading or ferrying to the field, access the "Save Point/Pattern" menu;
- b. Press "2" to retrieve;
- c. Enter the "Save Point/Pattern" number and press "Enter";
- d. Press the Flagger Switch and the WAG Flagger 2000 returns to the "Work" mode of the saved job.

### **2. Retrieving and returning to a point in a swath**

This function is used when the pilot has saved the point in a swath where the load ran out. It allows him to return to the point and resume applying the chemicals where he left off.

Steps for returning to a point in a swath:

- a. While reloading or ferrying to the field, access the "Save Point/Pattern" menu;
- b. Press "2" to retrieve;
- c. Enter the "Save Point/Pattern" number and press "Enter";

**NOTE:** The Approach™ Lightbar text will display the Heading on the left end and Bearing on the right end. The Approach™ Lightbar will also be providing the Cross Track.

- d. Return to the field and enter the swath from the same direction as before;
- e. Use the Approach™ Lightbar or the Cross Track on the Lightbar text to stay in the center of the swath;
- f. Start applying the load **before** the "Distance to the point" reaches "0", or there will be a "skip" in the application;
- g. After the application has started, press the Flagger Switch and the WAG Flagger 2000 will return to the "Work" mode;

**NOTE:** If the pilot wishes to enter the swath in the opposite direction, he simply presses "5 Flip" to flip the Approach™ Lightbar which orientates the WAG Flagger 2000 to this direction. The pilot starts applying the chemicals as soon as he enters the field and stops when the "Distance to Point" is "0".

## **C. Using Save Point/Pattern while flying multiple fields:**

### **1. Saving Point/Patterns while flying multiple fields**

When using the "Multiple Fields" feature, the WAG Flagger 2000 saves the "Point/Pattern" for each field separately. For example, if you are flying 3 fields, 3 Save Point/Patterns will be saved. The procedure is the same as saving a single "Save Point/Pattern", except there is a "Save Point/Pattern" number for each pattern.

### **2. Retrieving multiple "Save Point/Patterns" to fly multiple fields**

The WAG Flagger 2000 makes no distinction between a regular "Save Point/Pattern" and a "Save Point/Pattern" saved while flying multiple fields. For multiple fields, each "Save Point/Pattern" must be "retrieved" individually.

Steps for retrieving multiple "Save Point/Patterns":

- a. Access the "Save Point/Pattern" menu;
- b. Press "2" to "Retrieve";
- c. Enter the "Save Point/Pattern" number and press "Enter";
- d. Access the "Save Point/Pattern" menu again;
- e. Enter the number of **ADDITIONAL** fields to be retrieved, and press "Enter";
- f. Enter the "Save Point/Pattern" number for the next field and press "Enter";
- g. Enter the "Save Point/Pattern" number of the third field, if desired, and press "Enter";
- h. Enter the flight sequence that is to be flown;

**NOTE:** If only two fields are retrieved, the WAG Flagger 2000 will display the flight sequence menu after the "Save Point/Pattern" number for the second field is entered.

- i. Return to the first field and press the Flagger Switch to resume flying multiple fields.

## **XI. Homepoint:**

The WAG Flagger 2000 has a Homepoint feature which allows the pilot to leave a field and fly straight to the loading pad to refuel or reload, and then fly straight back to the field. There are 10 Homepoints numbered from 0 to 9.

### **A. Saving Homepoint:**

Steps for saving a "Homepoint":

1. Access the Homepoint menu by pressing the "8" key;
2. Press "3" to save the Homepoint;
3. Set an A/B line on your runway;
4. Enter the "Homepoint" number;
5. Press "Enter" and the WAG Flagger 2000 will return to the "Work" mode.

## **B. Retrieving Homepoint:**

In this mode, the WAG Flagger 2000 provides guidance to a particular Homepoint. When returning to a Homepoint, we suggest the Approach™ Lightbar text be programmed to display the Heading and Bearing. This is accomplished in the Setup/Scroll function. To return to a Homepoint, simply fly in the direction that makes the “Heading” and “Bearing” match. This will take the pilot to the “B” point, which is also the “Distance to”, in miles or kilometers. The Approach™ Lightbar will provide the guidance to stay in the center of the A/B line which was established when the “Homepoint” was created. After you have refueled or reloaded, press the Flagger Switch and the WAG Flagger 2000 will enter the “Return to Field” mode and provide the same information which allows the pilot to return to the field. Prior to entering the field, press the Flagger Switch again to return to the “Work” mode.

**NOTE:** When the distance to the “B” point is less than one mile or one kilometer, the Approach™ Lightbar text will show the distance in feet or meters.

Steps for using a Homepoint:

1. Access the Homepoint menu by pressing the “8” key;
2. Select Retrieve;

**NOTE:** If the WAG Flagger 2000 has been ON and you wish to retrieve the last Homepoint used, press “1” or press the “Flagger Switch”.

3. Enter the Homepoint number and press “Enter” or press the “Flagger Switch”;
4. Return to the Homepoint;
5. While reloading or refueling, press the “Flagger Switch” to enter the “Return to Field” mode;
6. Prior to entering the field, press the “Flagger Switch” again to return to the “Work” mode.

## XII. Troubleshooting:

This section deals with some of the problems the operator may encounter, as well as provide some solutions for them.

### A. No Valid Differential:

**Problem:** “No Diff” is displayed on the Approach™ Lightbar text when the WAG Flagger 2000 has reached the time limit allow waiting for the Differential Signal. The Control Pad will display:

“Cannot obtain valid differential. Please contact WAG or hit <Restart>”

#### **Solution:**

1. Press “Backspace” and then choose another Differential Source in the “Differential Menu”, accessed from the “Setup” menu;
2. Turn the WAG Flagger 2000 **OFF** and check the antenna connections on the Differential antenna and the WAGSTAR;

**NOTE: NEVER CONNECT OR DISCONNECT ANY CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 is ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

3. Clean the Differential Antenna with **MILD** soap and water;
4. If the system is equipped with WAG SAT, make sure the antenna has an unobstructed view of the sky;
5. Check all the connections and connectors in the wiring which is supplying power to the system. The wiring and connectors can become corroded, thereby reducing the current, not the voltage, to the WAG Flagger 2000.

### B. No Differential

**Problem:** “No Diff” can be displayed on the Approach™ Lightbar text at two different times:

**NOTE:** If the system is equipped with WAG SAT, it is normal for the WAG Flagger 2000 to display “No Differential” in a turn. However, this usually occurs at only one end of the field.

#### **Solutions:**

1. During Boot up of the WAG Flagger 2000:
  - a. Press “Setup” and select another Differential source;
  - b. Turn the WAG Flagger 2000 **OFF** and check the antenna connections on the Differential antenna and WAGSTAR;

**NOTE: NEVER CONNECT OR DISCONNECT ANY CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 IS ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

- c. Clean the Differential Antenna with **MILD** soap and water;

- d. Check all the connection and connectors in the wiring which is supplying power to the system. The wiring and connectors can become corroded, thereby reducing the current, not the voltage, to the WAG Flagger 2000.
2. During the “Work Mode”:
- a. Select another Differential source in the “Differential Menu”, which is accessed from the “Setup” menu;
  - b. Turn the WAG Flagger 2000 **OFF** and check the antenna connections on the Differential antenna and WAGSTAR;

**NOTE: NEVER CONNECT OR DISCONNECT ANY CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 IS ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

- c. Clean the Differential Antenna with **MILD** soap and water;
  - d. Check all the connections and connectors in the wiring which is supplying power to the system. The wiring and connectors can become corroded, thereby reducing the current, not the voltage, to the WAG Flagger 2000;
  - e. Refer to the “Differential Diagnosis” mode.
3. Differential Diagnosis Mode:  
This function is only available on WAG SAT systems. If your system is not equipped with WAG SAT, contact WAG Corporation or an authorized service center about your “No Differential” problem. If it is equipped with WAG SAT, then the operator needs to record the information obtained from this mode before contacting WAG or a service center. The last two pages of this manual are blank forms the operator can use to write the information down. Since the WAG Flagger 2000 supports both the OmniStar and Racal differential signals, the information is provided in different formats, depending on which differential source the system is using. There is a form for both systems.
- a. Press “Backspace”;
  - b. Access the “Differential Diagnosis” Mode by pressing “Setup” three times;
  - c. Record the information displayed on this screen;
  - d. Press “Setup” and record the information displayed on this screen;
  - e. Continue pressing “Setup” and recording the information until the system returns to the “Ready to Work” mode or the “Work” mode;
  - f. Contact WAG Corporation or an authorized service center.

C. No GPS Lock:

**Problem:**

It is normal for the WAG Flagger 2000 to display “No GPS” on the Approach™ Lightbar text while the aircraft is in a turn. However, this normally occurs at only one end of the field and for just a few seconds. The WAG Flagger 2000 can make reference to the GPS Lock at two points: 1) During Boot Up; and 2) During “Work” mode.

**Solution:**

- 1. During Boot Up of the WAG Flagger 2000:  
If the WAG Flagger 2000 is unable to obtain a GPS Lock within three

minutes, a Time Out will occur. "NO LOCK" will be displayed on the Approach™ Lightbar text and the Control Pad will read:

"Cannot obtain Lock. Check GPS antenna, Contact WAG or press <Restart> to rerun."

- a. Press "Backspace" and then "0" and check the "Status" line on the Control Pad, this will be displayed on the third line of the Control Pad 8 display;
- b. If the last two characters in the Status Line are "FF", press "Backspace" and then "Restart";
- c. If the last two characters in the Status Line are "FE", Turn the WAG Flagger 2000 **OFF** and check the antenna connections at the antenna and WAGSTAR;

**NOTE: NEVER CONNECT OR DISCONNECT ANY CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 IS ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

- d. Clean the antenna with **mild** soap and water;
- e. Make sure the antenna has an unobstructed view of the sky;
- f. If the last two characters in the Status Line are "DF", or the system still does not function, contact WAG Corporation.

2. During the "Work Mode":

- a. Press "0" six times and check the last two characters in the "Status" line;
- b. Follow b thru d above.

D. Error "9":  
**Problem:** The Control Pad is displaying "Error 9" during the Boot Up. This means the "Access Code" will expire within 72 hours. This feature avoids the operator having to keep up with expiration dates of various services provided by WAG Corporation. The operator should contact WAG Corporation **AS SOON AS POSSIBLE** to avoid a system shut down.

E. Error "6":  
**Problem:** "Error 6" is displayed on the Control Pad after entering an "Access Code". This error is displayed when the "Access Code" has been entered incorrectly.

**Solution:**

1. Enter the code again making sure the code is correct.
2. If the problem persists, contact WAG Corporation.

F. Error "1":  
**Problem:** "Error 1" is displayed on the Control Pad during the Boot Up. The Access Code has expired and the system has shut down.

**Solution:**

Contact WAG Corporation or an authorized service center.

G. "See KYP":  
**Problem:** "SEE KYP" is displayed on the Approach™ Lightbar text which means

read the control pad. The WAG Flagger 2000 can detect a number of different Errors, and this will be displayed on the Approach™ Lightbar text when they are detected.

**Solution:** The operator **MUST** read and make note of what the Control Pad is displaying, and either follow the instructions on the Control Pad, or contact WAG Corporation or an authorized service center.

H. Acreage counter:

**Problem:** If the WAG Flagger 2000 does not calculate the acres being treated or it calculates the acres incorrectly, the problem is usually a faulty switch.

**Solution:**

1. When the WAG Flagger 2000 is in the “Ready to Work” mode or the “Work” mode, press “0” ten times. The position of the dump handle or spray valve is shown on the top line of the Control Pad display;
2. When the handle or valves are closed, the position of the “Dump Handle” will be “OFF”. Likewise, when the handle or valves are open, the position of the “Dump Handle” will be “ON”;
3. Check the condition of the switches by opening and closing the handle or valves and noticing if the position of the “Dump handle” changes correctly;
4. If not, check the connections or the alignment of the switches for proper operation. Also, check the wiring for either a broken wire or a short in the wires. If your system is equipped with a pressure switch, make sure the switch is not clogged;
5. If the problem persists, contact WAG Corporation or an authorized service center.

I. Power:

**Problem:** If the WAG Flagger 2000 is turned ON but **NOTHING** is displayed on the Approach™ Lightbar text or the Control Pad:

**Solution:**

1. Turn the contrast knobs for the displays clockwise to their maximum position;

**NOTE: NEVER CONNECT OR DISCONNECT ANY CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 IS ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

2. Check the connections on the back of the Control Pad;
3. Check the power source;
4. Check all the connections and connectors in the wiring that are supplying power to the system. The wiring and connectors can become corroded, thereby reducing the current, not the voltage, to the WAG Flagger 2000.

J. Resetting:

**Problem:** The system resets itself for no apparent reason.

**Solution:** This problem is usually caused by a bad system ground or corroded wires and/or connectors. If there is corrosion, all connectors must be redone. Otherwise, the system will have enough voltage but not enough current.

K. Solid dark characters:

**Problem:** The displays have solid dark characters on them.

**Solution:**

1. "Soft Boot" the system by turning the "Contrast" knob on the Control Pad counterclockwise until you hear a click. Turn the knob back to its original position;
2. Turn the WAG Flagger 2000 **OFF** and check the connections on all of the cables.

**NOTE: NEVER CONNECT OR DISCONNECT THE CABLES OR ANTENNAS WHILE THE WAG FLAGGER 2000 IS ON. CARE MUST BE TAKEN NOT TO TOUCH THE END OF THE CABLES AND THE PINS IN THE CONNECTORS OF THE VARIOUS COMPONENTS AS TO AVOID DAMAGING THE SYSTEM.**

### **XIII. Glossary of Terms:**

**A/B line** - This establishes the line the pilot wishes to work from.

**Acres/Field** - Total number of acres sprayed in a particular field.

**Acres/Pass** - The number of acres being covered on each pass.

**Approach™ Lightbar** - The CDI, Course Direction Indicator, which is usually mounted on the outside of the plane to give the pilot a heads up view the information he needs.

**Bearing** - The direction the plane should go to reach a particular point. Fly so that the Bearing is the same as the Heading.

**C line** - Establishing this line enables the WAG Flagger 2000 to determine the dimensions of the field.

**Control Pad** - The box mounted inside the cockpit which consists of the pushbuttons and the 4-line display.

**Cross track** - The distance from the plane to the center of the intended path.

**Differential age** - The amount of time elapsed since the last differential correction was received by the WAGSTAR. The older the age, the more likely error will be introduced into the system.

**Differential correction** - Signal transmitted from a known point to improve the accuracy of the WAG Flagger 2000.

**Distance to** - The distance at any time between the plane and a given point. Used in the Save Point/Pattern, Lat/Lon, and Homepoint modes.

**ETA** - Estimated time of arrival.

**Flagger switch** - The remote switch generally used to advance to the next swath.

**GPS** - Global Positioning System. The Department of Defense system that provides continuous and worldwide position, velocity, and time data.

**GPS lock** - When the GPS receiver "tracking" enough satellites and has obtained enough information to provide position and velocity information, it is said to have a lock.

**Ground Speed** - Denoted by "Gnd. Spd" it is the speed of the plane over the ground.

**Heading** - The direction the plane is going, with respect to True North. Note the GPS receiver is only capable of reporting the direction of motion and not the actual heading of the plane.

**Homepoint** - A convenient way for the pilot to define several "home" strips and thus have guidance to the "home" strips.

**Intercept angle** - The angle the aircraft is approaching the swath. For example, if the airplane is flying parallel to the swath the angle will approach 0 or 180 degrees if the aircraft is going in the opposite intended direction of the swath. If the aircraft is approaching the swath at a perpendicular line, the angle should approach 90 or 270 (180 + 90) degrees. Note that the GPS receiver is only capable of reporting the direction of motion and not the actual heading of the plane.

**Return to Field** - The mode the WAG Flagger 2000 enters when the pilot presses the "Flagger Switch" after he has return to a "Homepoint". This mode provides the information the pilot needs to return to a field.

**Save Point/Pattern** - Save Point/Pattern allows the pilot to save the complete state the WAG Flagger 2000 is in so the job can be resumed where it was discontinued at any time without losing any information.

**Swath** - The line that the pilot is currently flying on.

**Swath width** - The width of the swath the pilot flies.

**Swath mode** - The mode the WAG Flagger 2000 is in when the pilot is actually treating a field.

**Units** - Type of measurement the information is presented. The units of measurement are either Imperial or Metric.

**UTC** - Universal Time Coordinates.

**Vertical Speed** - Denoted by "Vert. Spd", it is the rate in which the plane is ascending.

**WAGSTAR** - The box mounted inside the body of the aircraft containing the various receivers the WAG Flagger 2000 can use.

**Waypoint** - Latitude and Longitude point that can be saved in the Lat/Lon mode.

**Work left** - The field is to the left of the A/B line.

**Work right** - The field is to the right of the A/B line.

## XIV. RACAL DIFFERENTIAL DIAGNOSIS INFORMATION

1. Obtain the "Ready to Work" or the "Work" modes.
2. Press "Setup" two times:  
Fix:                   Age:  
SID:                   SAT:  
HDOP:

**NOTE:** The "HDOP" and the "Diff. Count" will alternate every 5 seconds. Only need to record the "HDOP".

3. Press "Setup" again:  
Channel:  
Rate:  
Freq:
4. Press "Setup" again:  
Dem:                   Ber:  
SS:                    AGC:  
Dec:                   Alrm:
5. Press "Setup" again:  
Decoder ID:  
Service ID:  
Offset:
6. Press "Setup" again:  
User:  
87c:                   80c:  
Dsp:

**NOTE:** Some system will display:  
User:  
OTP:                   Dec:  
Cst:                   Dsp:

7. Press "Setup" again:  
Port:                   Mode:  
Baud:  
Format:

**NOTE:** Some system will display:  
Port:                   Dir:  
Mode:  
Fmt:

8. Press "Setup" again:

**NOTE:** Some system will display a series of numbers, the series depends on where in the world the system is located. Simply record all the numbers on this screen. Other systems will display:

Port:           Dir:  
Mode:  
Fmt:

9.     Press Setup again:

**NOTE:** Some system will return to the "Ready to Work" mode. Other systems will display:

Beam:  
Channel:

10.    Press Setup again:

A series of numbers, the series depends on where in the world the system is located will be displayed. Simply record all the numbers on this screen.

**NOTE:** Other systems will continue displaying different information.

## XV. OMNISTAR DIFFERENTIAL DIAGNOSIS INFORMATION

1. Obtain the "Ready to Work" or the "Work" modes.
2. Press "Setup" two times:  
Fix:                      Diff. Age:  
SID:                      SAT:  
HDOP:

**NOTE:** The "HDOP" and the "Diff. Count" will alternate every 5 seconds. Only need to record the "HDOP".

3. Press "Setup" again:  
Data:  
Ser#:  
Power:

**NOTE:** Some systems will display:

Data:                      Fw:  
Ser#:  
Power:

4. Press "Setup" again:  
Freq:  
A. Freq:  
Difference:
5. Press "Setup" again:  
Sites:  
Mode:  
SID:

**NOTE:** Some systems will display:

Sites:  
Mode:  
SID:                      S/Q:

6. Press "Setup" again:  
Expiration Time:
7. Press "Setup" again:  
Count down timer:
8. Press "Setup" again:  
Symbol Rate:  
Security:

**NOTE:** Some systems will display:

Symbol Rate:  
Security:  
FW: