

**MBTS SOFTWARE VERSION 5.0**  
**ADDENDUM TO THE**  
**MONOPULSE BEACON TEST SET (MBTS) II**  
**SYSTEM OPERATIONS/TRAINING MANUAL**



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## **MBTS SOFTWARE VERSION 5.0 ADDENDUM TO THE MONOPULSE BEACON TEST SET (MBTS) II SYSTEM OPERATIONS/TRAINING MANUAL**

### **1 PURPOSE**

This document describes the basic differences between an MBTS II operating with software version 5.0 (MBTS) and version 5.0 (OCS), which includes the ability to simulate a high number of aircraft, and the previous generation of software, versions 4.4 (MBTS) and 4.2 (OCS).

### **2 FUNCTIONAL CHANGE DESCRIPTION, SOFTWARE VERSION 4.X TO 5.0**

The two primary functions added to MBTS capability by the latest revision software (Ver. 5.0) are greatly increased target count, while operating in Azimuth Gated Target Mode, and more versatile target movement. The MBTS II running with MBTS software version 5.0 and OCS version 5.0 must be configured with two Reply Generator modules to operate properly.

The MBTS II operating with the previous generation software (MBTS version 4.4 and OCS version 4.2) allows target generation in 32 azimuth sectors. Each Reply Generator can place one target in each sector with the number of sectors limited to 1, 2, 4, 8, 16, or 32. All sectors use the same power level and target range settings. Movement is restricted to replies generated by the secondary Reply Generator.

The MBTS II operating with the revision 5.0 software allows target generation in up to 64 azimuth sectors. The target output power level is set on a sector by sector basis with replies from each of the two Reply Generators controlled independently. Each sector can have from zero to 32 targets per Reply Generator, with target count completely configurable on a sector by sector basis. The MBTS II, therefore, can generate reply responses from up to 4,096 targets per radar scan.

### **3 MBTS II CONTROLS AND OPERATION - SOFTWARE VERSION 5.0**

#### **3.1 General Operation**

Most reply settings of each target within a given azimuth sector are configurable completely independent of all the other targets within that same sector. Only the timing of Mode 4 replies (generated by the same Reply Generator) is shared by all targets within a given sector. The capability to generate a Mode 4 response is set on a target by target basis.

Each target can be configured with a unique probability of reply. This capability is in addition to the Mode S probability of reply data settings and is applied to all reply types (ATCRBS, Mode S, and Mode 4).

The OCS software controls the range setting of all targets within a given azimuth sector, as created by a single Reply Generator, so as to eliminate the chance of creating overlapping replies. Overlapping replies can only be created through the use of both Reply Generator signal channels.

The MBTS II can use both Reply Generators sections to create independently configurable moving targets. Flight pattern table calculation software is used to implement either straight line or any of three different figure eight target movement. Target movement, utilizing more complex flight patterns, may be implemented through the use of a selectable custom movement table. Contact Freestate Electronics for more information about how to create custom movement tables.

## 3.2 Azimuth Gated Target Controls

The location of some OCS Azimuth Mode controls has changed from previous software releases (OCS Version 4.x). The Target Type, Target Range, Target Azimuth, Target Count, and Power Level controls, previously located on the main page of the OCS control panel, have been moved to a new Set Reply Parameters window.

Within the Set Reply Parameters window, target generation and reply characteristics are set through the use of four new controls: **Global Configuration**, **Sector Configuration**, **Target Configuration**, and **Sector Copy**. These new controls have been added to assist the operator in handling the much larger target capacity of the MBTS. The Static/Moving Target Configuration and Reply Pulse Parameters settings apply to all of these four control modes.

### 3.2.1 Global Configuration

Using the Global Configuration control is the fastest way to create a large number of targets. This is accomplished by activating targets in the desired azimuth sectors, choosing the number of targets within each sector, and setting target characteristics for each sector.

Select the Global Configuration Button –it will turn green.

Use the Active Sectors control to activate the desired azimuth sectors – this is similar to the Target Count control of the MBTS II.

Use the Targets Per Sector control to select the number of targets to place in each active sector.

Use the row of panels at the top of the Global Configuration window to set target parameters: Reply Codes, Range, Probability of Reply, and Target Type. Note that if target movement is enabled (through use of the Moving Target Configuration control) the Range control will be disabled.

Set the output power level and the Mode 4 reply group delay settings. These settings will apply to all targets.

Select the yellow Apply Global Settings control to configure the MBTS – it is yellow when the displayed settings have not been applied to the MBTS and green when the MBTS configuration matches the OCS display.

Use the Globally Set Incrementing ID And Aircraft Address control if you want all targets to have unique 3/A codes and Aircraft Addresses. If this control is yellow multiple targets could reply with the same Mode 3/A code or Mode S Aircraft Address.

### **3.2.2 Sector Configuration**

The Sector Configuration control is used to change target count or to globally modify the reply characteristics of targets within any given azimuth sector. Note that any changes to the Output Power or Mode 4 Reply Group settings while operating within the Sector Configuration mode are applied immediately.

Select the Sector Configuration Button – it will turn green.

Use the Sector Select control to configure the desired sector. The current state of the selected sector will then be displayed.

Use the Targets In Sector control to select the desired number of targets within the sector. The reply parameter control panels, at the top of the OCS window, will not be displayed if the Targets In Sector control is set to zero.

Use the reply parameter control panels at the top of the window to globally set the reply characteristics of all sector targets. Reply Codes, Range, Probability of Reply, and Target Type may be adjusted. Note that if target movement is enabled (through use of the Moving Target Configuration control) the Range control will be disabled.

Select the yellow Apply Global Settings control to configure the MBTS – it is yellow when the displayed settings have not been applied to the MBTS and green when the MBTS configuration matches the OCS display.

Use the Globally Set Incrementing ID And Aircraft Address control if you want all targets to have unique 3/A codes and Aircraft Addresses. If this control is yellow multiple targets could reply with the same Mode 3/A code or Mode S Aircraft Address.

### **3.2.3 Target Configuration**

The Target Configuration control is used to change the reply characteristics of individual targets. Note that all changes to target characteristics are applied as they are made.

Select the Target Configuration Button – it will turn green.

Use the azimuth Sector Select and Target Select controls to pick a target to configure. Note that the Target Select control does not allow the selection of targets beyond the first disabled target in a given sector.

Use the reply parameter control panels at the top of the window to set the reply characteristics of the selected target. Reply Codes, Range, Probability of Reply, and Target Type may be adjusted. Note that if target movement is enabled (through use of the Moving Target Configuration control) the Range control will be disabled.

Select the yellow Apply Global Settings control to configure the MBTS – it is yellow when the displayed settings have not been applied to the MBTS and green when the MBTS configuration matches the OCS display.

Use the Globally Set Incrementing ID And Aircraft Address control if you want all targets to have unique 3/A codes and Aircraft Addresses. If this control is yellow multiple targets could reply with the same Mode 3/A code or Mode S Aircraft Address.



### **3.2.4 Sector Copy Control**

The Sector Copy Control is used to copy the target settings and parameters of one azimuth sector to another.

Use the Source Sector Control to select the azimuth sector to be copied.

Select (turn yellow) the sectors you wish to be the copy target.

Use the yellow Copy control.

Use the Globally Set Incrementing ID And Aircraft Address control if you want all targets to have unique 3/A codes and Aircraft Addresses.

### 3.3 Static/Moving Target Configuration Control

The Static/Moving Target Configuration Control is used to set and implement target movement. It contains the controls that allow the user to select movement parameters to apply to one of a number of specific flight pattern scenarios. These scenarios include straight line movement and three different styles of figure eight movement. Alternatively, the operator may choose to select and use a flight scenario of their own making. Contact Freestate Electronics, Inc. for details on how to generate custom flight scenarios.

Use the Static Target Configuration control to toggle it to Moving Target Configuration.

Use the control at the bottom of the window to select the desired type of movement.

#### 3.3.1 Straight Line Movement

Select the Range and Azimuth of the **center point** of target movement.

Select the Speed, Distance, and Heading desired.

Select the Start Movement Control.

#### 3.3.2 Figure Eight Away

This scenario creates a figure eight flight pattern in which the centers of the two circles are located on the same azimuth radial.

Select the Range and Azimuth of the **center point** of the flight pattern.

Select the Speed and Radius desired.

Select the Start Movement Control.

### 3.3.3 Figure Eight Beside

This scenario creates a figure eight flight pattern in which the centers of the two circles are located perpendicular to a selected azimuth radial.

Select the Range and Azimuth of the **center point** of the movement.

Select the Speed and Radius desired.

Select the Start Movement Control.

### 3.3.4 Figure Eight Around

This scenario creates a figure eight flight pattern in which the center of one of the two movement circles is positioned on top of the SSR radar.

Select the Range and Azimuth of the **center point** of the movement.

Select the Speed desired.

Select the Start Movement Control.

### 3.3.5 Custom Motion

This control loads a selected custom motion file into the MBTS. Motion files are used to implement complex target flight pattern scenarios. Please contact Freestate Electronics for assistance in creating motion files.

Three custom motion files are included with the OCS: **L200.mot**, **L200\_1\_deg.mot**, and **R400.mot**.

The setup file CustMov.ocs creates a flight scenario that uses L200.mot on the primary Reply Generator and R400.mot on the secondary Reply Generator.

The setup file CustMov1Deg.ocs creates a flight scenario that uses L200\_1\_deg.mot on the primary Reply Generator and R400.mot on the secondary Reply Generator.

Use the Start Movement control to select and start a custom motion flight scenario.

### **3.3.5.1 L200.mot**

Target motion starts at 0 degrees and 50 NMI. The target moves at 200 knots toward the radar (heading 180). At a range of 20 NMI the target executes a 1G turn to a heading of 270 degrees. Pattern generation runs for 13 minutes and then restarts.

### **3.3.5.2 L200\_1\_deg.mot**

Target motion starts at 359 degrees and 50 NMI. The target moves at 200 knots toward the radar (heading 179). At a range of 20 NMI the target executes a 1G turn to a heading of 269 degrees. Pattern generation runs for 13 minutes and then restarts.

### **3.3.5.3 R400.mot**

Target motion starts at 0 degrees and 80 NMI. The target moves at 400 knots toward the radar (heading 180). At a range of 20 NMI the target executes a 1G turn to a heading of 90 degrees. Pattern generation runs for 13 minutes and then restarts.