FlightMax™

Flight Situation Display

TCAD	ON .
shield	UNLTD
range	6.0 iNM
audio	MUTED

3.5NM/+04 ↑

+02 812QM

+02
N825WE

1NM

-02   6NM

1 ⊞ ▓ 00:00 TRAFFIC 11 o'clock / 0.9 NM / + 200 FT
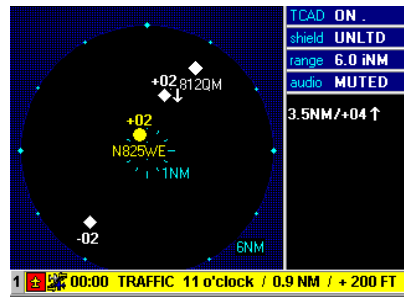
FlightMax Traffic

(TCAD)

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release
May 18, 2001	01	Production Release per ECO 01-052
Feb. 6, 2002	02	Production Release per ECO 02-038

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Introduction

This part of the Pilot's Guide explains FlightMax Traffic and its use in conjunction with the Ryan Traffic and Collision Alert Device (TCAD) 9900B and 9900BX. Topics include:

Figure 1: Traffic Icon

- *Traffic Overview* - presents an overview of the Traffic function and the TCAD sensor.

- *Traffic Pages and Menus* - explains every page and menu used in FlightMax Traffic.

- *How to Use Traffic* - explains how to perform specific tasks using Traffic.

- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications.

- *Menu Tree* - shows the path to any menu in Traffic.

FlightMax Traffic is verified by the presence of its icon and text label in the Main menu. If Traffic's icon and legend, shown in Figure 1, are not present in the Main menu, contact your installer for assistance.

Before reading this section, you should read and understand the Ryan TCAD 9900 series User's Guide. It contains information essential to the proper use and interpretation of the displays presented by Traffic.

Traffic Overview

FlightMax Traffic displays Traffic avoidance data gathered by the Ryan TCAD. Proper use of FlightMax Traffic with the Ryan TCAD can improve situational awareness of potential threat aircraft.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. This is accomplished by displaying the intruder aircraft's horizontal and, if altitude information is available, vertical position relative to the host aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems alert pilots to other aircraft within their immediate airspace. They all consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antennas (Figure 2). The FSD replaces or supplements the display unit. It provides additional information and simplified recognition of potential threat aircraft.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.
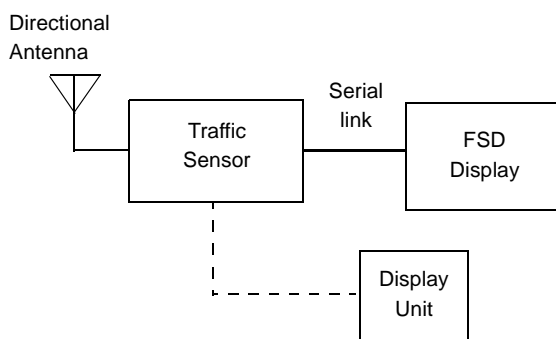

Figure 2: Traffic System Block Diagram

TCAD Description

TCAD consists of three major assemblies as well as two aerodynamically designed blade antennas:

- The Traffic Sensor (Ryan refers to this unit as the Remote Processor)

- The Display

- The Transponder Coupler

The FSD replaces the Display unit, although the user has the option of continuing to use the TCAD display. The Traffic Sensor, the Antenna and the Transponder Coupler are still required. The FSD receives all its data from the Traffic Sensor. All displays on the FSD are generated using data from the Traffic Sensor.

The 9900B receives and processes transponder signals from nearby aircraft to provide traffic alert information. Threat range is determined from the received amplitude of the transponder. Amplitude changes with range, and is used to calculate range and trend data. The increase or decrease of range data shows the trend in range. This trend information, particularly in closure situations, is important for effective collision alert, and is essentially independent of power variations among transponders.

The 9900BX also interrogates transponders from nearby aircraft. The vertical separation of host and intruder is determined by comparing decoded altitude replies to the host's altitude. The range is determined using radar time to arrival technique. Bearing is determined using the dual directional antennas mounted on the top and bottom of the aircraft. Altitude date from the intruder is referenced to pressure altitude (29.92 inches or 1013mb), as is the onboard encoder providing separation information.

The TCAD displays threats detected within a predetermined volume of airspace (the Air Traffic Shield). The size of the shield can be selected by the pilot, based on anticipated traffic conditions, using the various modes available within TCAD.

Traffic Pages and Menus
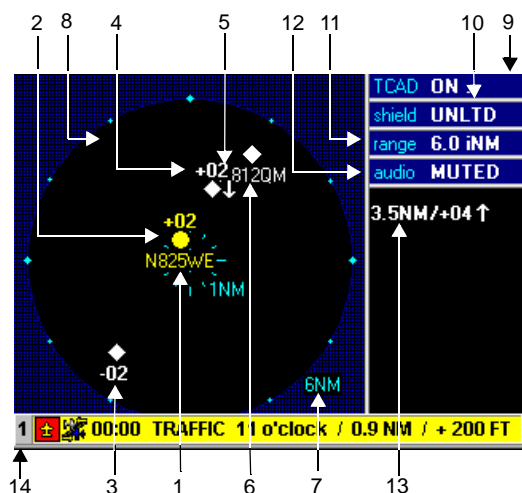
Data Page Layout

Figure 3: Data Page

1. **Aircraft Symbol** - This symbol represents your aircraft.

2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.

3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is close to your aircraft but does not generate a TA.

4. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet above you.

5. **Vertical Trend** - This symbol represents the vertical

trend of an intruder aircraft. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending relative to your aircraft. No arrow indicates an intruder flying: level flight, or a non-altitude reporting intruder.

6. **Aircraft Identifier** - When available, an intruder identifier is displayed below the other intruder data, in the same color as the symbol. The identifier is the N-number or the Squawk code.

7. **Range** - This indicator shows the range rings and range indicators. The available ranges are dependent on the sensor used. The blue field around the outermost ring represents the limits of the sensor.

8. **System Status Annunciation (not shown)** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber and include the following: SENSOR OFF, SENSOR DATA FAIL, OFFSCALE

9. **TCAD Status** - The TCAD indicator displays the current status of the sensor. The possible displays are: Off, On and Fail. When the sensor is On there is a moving period within the display. The moving period confirms that the sensor is On and not locked up.

10. **Shield Status** - The shield indicator displays the current shield being used. The Air Traffic Shield is the optimum volume of airspace monitored by the TCAD. There are five shields selectable by the pilot: Ground, Terminal, Standard, Enroute, and Unlimited. Approach and Departure modes are automatic modes and are not pilot selectable.

11. **Sensing Range** - The range indicator displays the range being used by the current shield. The shields are set to a specific value in indicated nautical miles (iNM).

12. **Audio Status** - The audio indicator displays the status of the audio function within TCAD. When the system is muted, audible warnings are silenced for a specified duration. Mute does not disable Altitude Alert tones.

13. **Traffic Text** - Threats and other intruders which can't be depicted in the view pane due to lack of bearing or range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance

or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

14. **Message Bar** - If a function other than Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD will display a bright yellow message bar along the bottom of the screen. This alerts the pilot to a TA. The message bar includes the TA's bearing, distance, and relative altitude (if available). The pilot can access the Traffic display by pressing Enter.

Traffic Main Menu

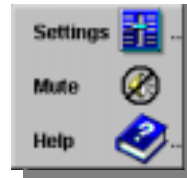The Traffic main menu provides control of the following functions.

Settings

Selecting Settings will bring up the Settings Page 1. Approach mode is enabled or disabled at this page. From this page you can access the Settings Page 2. Shield size, mute duration and audio volume are configured on this page.

Figure 4: Main Menu

Mute

Mute is a toggle function that silences or restores the TCAD audio alerts. Muting is temporary and the time of the mute is configured at the TCAD Setting Page 2.

Data Pane Displays

Status of the system is displayed in the right hand column of the Traffic Data page. There are four constant displays: TCAD status, shield status, sensing range and audio status.

Figure 5: Data Pane

TCAD status

The TCAD display indicates the status of the system.

Off

Is displayed if the TCAD is offline.

On

Indicates that the unit is functioning. In addition to the verbiage, there is a horizontally moving period at the end of the word ON. The continuously moving period indicates that the system is on and not locked up.

Fail

Indicates that the system is not functioning properly. The pilot should note any unusual displays, including any numbers or letters to assist maintenance.

Shield status

Displays what air traffic shield is presently being used. The Air Traffic Shield describes an adjustable volume of airspace, controlled by the pilot, to display potential threats, yet prevent extraneous traffic from being displayed.

The Air Traffic Shield has a specified radius and height above and below the aircraft.
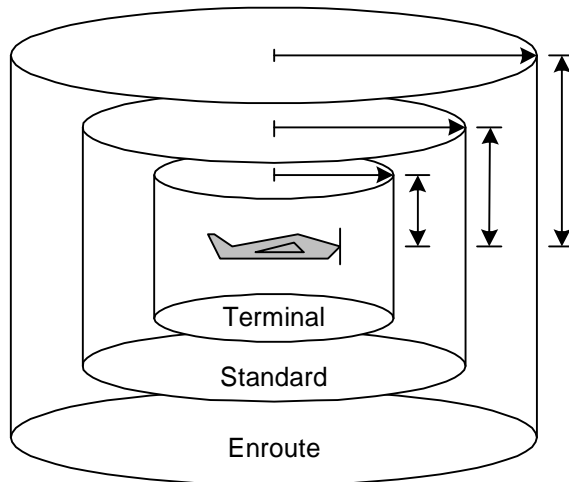
Figure 6: Shields

The following shields are available:

Enroute (ENRT)
Is used when the aircraft is at cruise. A large volume of airspace should be monitored because traffic is usually light, and threats could approach at high speeds and high rates of climb or descent.

Standard (STD)
Is used when transitioning from enroute flight. Traffic usually becomes more dense and the speed of potential threats is usually lower. Therefore a smaller shield size would be appropriate.

Terminal (TRML)
Is used when in the terminal area, because a smaller volume of airspace is generally best, in order to display threats and prevent display of extraneous traffic.

Ground (GND)
Is activated automatically upon startup or after landing by selecting it. Ground has a 200 foot ceiling for sensing intruders. TCAD will automatically transition from Ground Mode to Enroute mode after takeoff.

CAUTION

Do not operate TCAD in the Ground Mode when in flight.

Unrestricted Mode (UNLTD)
Can be used in place of enroute mode, if you need to
expand the monitored airspace beyond the enroute shield.

Approach/Departure
Are transition modes that are non selectable by the pilot
during flight. These modes automatically eliminate tones
caused by aircraft on the ground as you approach or depart
the runway. The approach mode can be enabled or
disabled at the TCAD settings page. If approach is
enabled, the pilot has to enter a destination field elevation.

Range

This display reflects the sensing range corresponding to
the current shield being used. The supported Ryan TCAD
models are capable of operating in two different modes for
sensing range: active or passive. In active mode the TCAD
utilizes an interrogator to request transponder replies from
nearby aircraft. In passive mode the TCAD listens to
transponder replies triggered by external interrogators.
Active mode provides greater range detection.

> **NOTE:** The model 9900B is only capable of operating
> in passive mode.

The operator can set the (horizontal) display range to the
following:

9900B: 1, 3 or 6 miles.

9900BX: 1, 3, 6, 10 or 20 miles.

The maximum selectable display range is the smallest
display range that is greater than or equal to the current
shield radius.

For example: if the Standard shield is selected and its
radius is 2 miles, the 6 mile range is not selectable.

Audio

This display indicates the status of the Audio alerts, whether they're active or muted. The Audio function of TCAD is still active when the FSD is being used. Aural Traffic awareness warnings are generated from the TCAD Traffic Sensor and connected directly to the aircraft audio system. The pilot still has the capability to enable or disable voice alerts. The pilot is able to activate/deactivate the Mute function and change its duration (10-240 seconds).

Traffic Text

Intruder aircraft whose bearing cannot be determined by the sensor are called non-bearing aircraft. These aircraft are listed in the text column as shown in Figure 3. The range in nautical miles and the altitude relative to your aircraft (above or below) is displayed if available.

Control Knob Indicator

A Shield/Zoom display in the lower right hand corner, indicates the functions of the inner and outer knobs.

How to Use Traffic

Accessing Traffic

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To use Traffic press **Esc** to bring up the Main Menu then select TRAFFIC. Traffic then displays its data page and main menu.

Control Knob Functions

Outer Knob - Altitude

The outer knob is used to select between the different altitude modes (shields). The available shields are: Enroute, Standard, Terminal, Ground, and Unlimited.

Inner Knob - Range

The inner knob is used to select the display range (scale).

Turning the knob counter clockwise will decrease the range scale. Once the display range is at the lowest range, further counter clockwise turns will have no effect.

Turning the knob clockwise will increase the range scale. Once the display range is at maximum range, further clockwise turns will have no effect.

In the outer most scale a dark blue field surrounds the outside of the maximum radius. This indicates that aircraft are not detected beyond that range.

Configuration Settings

Approach Mode

To enable the Approach Mode do the following:

1. Bring up the Traffic Main menu and select Settings. The Settings Page is displayed (Figure 7).

2. Use the inner knob to place a check mark in the Enable field.

3. Use the outer knob to select Field Elevation.
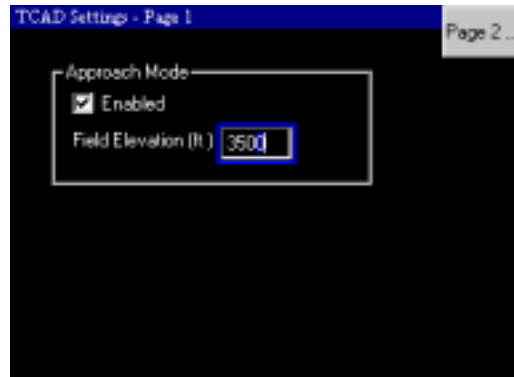
4. Use the inner knob to set the Field Elevation

Figure 7: Settings Page 1

Audio Configuration

To change the audio settings use the following procedure :

1. Bring up the Traffic Main menu and select Settings, then select Page 2..

2. Use the outer knob to select the Enable Voice Alerts box if you want to have audio alerts. Use the inner knob to place a check in the box.

   The system will generate a repetitive alert tone when a threat aircraft is within ±500 and 1.0iNM. The repetition rate increases when the threat aircraft is within ±300 feet and 0.7iNM. Enabling the Voice Alert means the last tone is replaced by the word "traffic".

3. The mute function silences audible warnings for a specified duration. Select the Mute Duration pull down list to define the duration of the mute (10 to 240 seconds in 10 second intervals). Use the outer knob to select the window and the inner knob to select the duration.

4. The volume setting is also adjustable. The range is adjustable by using the inner knob. Clockwise raises the volume. Counter clockwise reduces it.
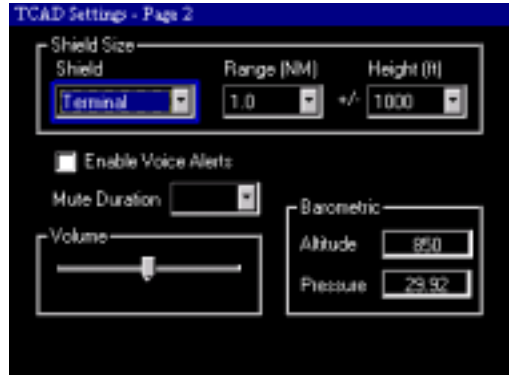
Figure 8: Settings Page 2

Setting the Shield size

When a shield is selected the maximum selectable range is applied. To change the parameters of a shield do the following:
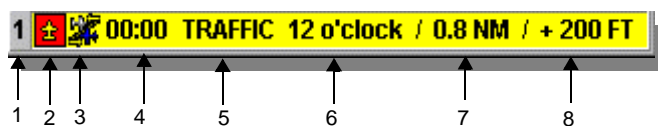
1. Bring up the Traffic Main menu and select Settings, then select Page 2.

2. Use the outer knob to select the Shield window. Use the inner knob to select the Shield from the drop down menu. There are 3 shields that can be modified: Terminal, Standard, and Enroute.

3. Use the outer knob to select the Range or Height windows. Use the inner knob to select the desired values from the respective drop down lists. The drop down lists contain the appropriate parameters for each shield.

Messages and Error Indications

The system status annunciation describes the operating state of the system. The status is displayed in Cyan letters across the main Data page.

Message Bar

The Traffic Advisory message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page, the message bar will appear in yellow across the bottom of the screen. The yellow background indicates that confirming this message (by pressing enter) will take you to the issuer's data page (in this case Traffic).


```
1 [±][✈] 00:00  TRAFFIC 12 o'clock  /  0.8 NM  /  + 200 FT
  ↑  ↑  ↑     ↑           ↑            ↑          ↑
  1  2  3     4           5            6          7          8
```

1. Number of messages awaiting Confirmation

2. Priority

3. Issuer

4. Elapsed time since message was issued

5. Type of Message

6. Bearing to intruder

7. Range in nautical miles

8. Vertical Separation

Traffic Intruder Display Criteria

The FSD traffic function receives its data from the TCAD sensor. The FSD is a slave to the TCAD sensor. The criteria that TCAD uses to acquire and display intruder threats determines what will be displayed on the FSD.

The TCAD processor uses several criteria to determine the existence of potential threat aircraft.

TCAD can monitor more than 50 aircraft at one time, the

FSD can display up to nine aircraft on its screen. Generally, the shield size should be reduced when three threats are detected within the monitored area.

The following criteria are necessary to locate intruders:

Bearing
The TCAD Model 9900B and 9900BX series use a patented Split Array antenna system and receivers to provide bearing to the traffic. The direction of the traffic is determined using the top and bottom antennas. The top antenna, consisting of two L-band elements, provides the front/aft resolution. The bottom antenna provides for left/right determination. The signals are combined and bearing to the traffic is presented to the FSD.

Range
The 9900B uses signal strength to determine the range of traffic. The 9900BX has an active interrogation system to determine range.

Non Altitude threats
The TCAD can detect aircraft without altitude-reporting capability. In this situation, TCAD provides iNM and horizontal closure information. When your aircraft is above 12,000 feet pressure altitude, non-Mode C traffic is not displayed.

Update Rate
TCAD is updated by transponder replies from threat aircraft.

Mode A

The Ryan TCAD processing function decodes and pairs Mode A and C replies from threat aircraft, and sends the data on to be prioritized and displayed. A few ATC assigned Mode A codes are identical to Mode C codes, making it difficult for the processor to determine which of the A/C pair is the Mode A and which is the Mode C. In this case, both combinations are prioritized and displayed. If the threat aircraft or Mode A image is within the shield, it will be displayed. In the unlikely event that both the Mode A image and the threat are detected inside the monitored area, the combination is treated as a multiple

threat.

The optimum volume of airspace to be monitored by Traffic changes with traffic density. When traffic is light, and aircraft are at cruising speeds, a large volume of airspace should be monitored. In higher density airspace, when the pilot is more alert for traffic and speeds are limited, a smaller surveillance volume is generally appropriate.

Menu Tree

The following Menu Tree graphically depicts the paths to all the Traffic menu functions.

```
Traffic ──────── Hide Menu
            ├── Mute
            ├── Settings
            └── Help
```