

**Airplane Flight Manual Supplement
Capstone System Installation**

UPS Aviation Technologies
2345 Turner Rd. SE
Salem, OR 97302

March 21, 2003
Part #:560-1028-03 Rev A

**FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for
CAPSTONE SYSTEM INSTALLATION
as installed in**

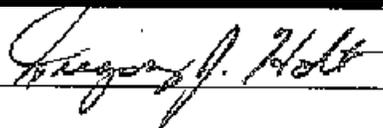
Make and Model Airplane

Registration Number _____

Serial Number _____

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Capstone Avionics system. This document must be carried in the airplane at all times when the Capstone Avionics System is installed in accordance with Supplemental Type Certificate No. SA02149AK. The information contained in this document supplements or supersedes the information made available to the operator by the manufacturer in the form of clearly stated placards, markings, or manuals as required by CAR 3.777(b) or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic placards, markings, or manuals or the basic FAA approved Airplane Flight Manual.

FAA Approved: _____



Manager, Anchorage Aircraft Certification Office
Federal Aviation Administration
Anchorage, Alaska
Date: March 21, 2003

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Revision Log						
Rev	Date	Description	EN	By	Auth	Chk
00 -	11/11/99	Initial release, Word 97 SR71	6229	CWH	-	-
01 -	01/28/00	Revision for STC amendment to include MX & UAT radio	6400	CWH		
01 A	04/27/00	Revised for GX50/60 references	6528	RMF		
02 -	07/28/00	Revised for FIS/TIS/Obstructions/Altitude filter/UAT RX only	6607	CWH		
03 -	11/29/00	Revised for Ident function, terrain advisories during cold weather ops, degraded targets and tan targets at 35 kts.	6764	CWH		
03 A	10 Mar 2003	Include MX20 SW changes up to version 4.1 (add terrain thumbnail, add annunciator colors, update preheat temperature) and GX50/60 SW changes up to v3.5 Nav and v2.5 GPS.	7587	MAK		

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1. GENERAL

The Apollo GX50 and GX60 are TSO-C129a Class A1 GPS supplemental navigation systems with a built-in moving map graphics display. The GX50/60 is capable of being authorized for IFR/VFR en route oceanic and remote, en route domestic, terminal, and non-precision approach operation. However, this **installation is limited to Supplemental VFR Navigation only.**

1.1 APOLLO GX50 GPS DESCRIPTION

The Apollo GX50 is a GPS only unit and is powered from a single circuit breaker.

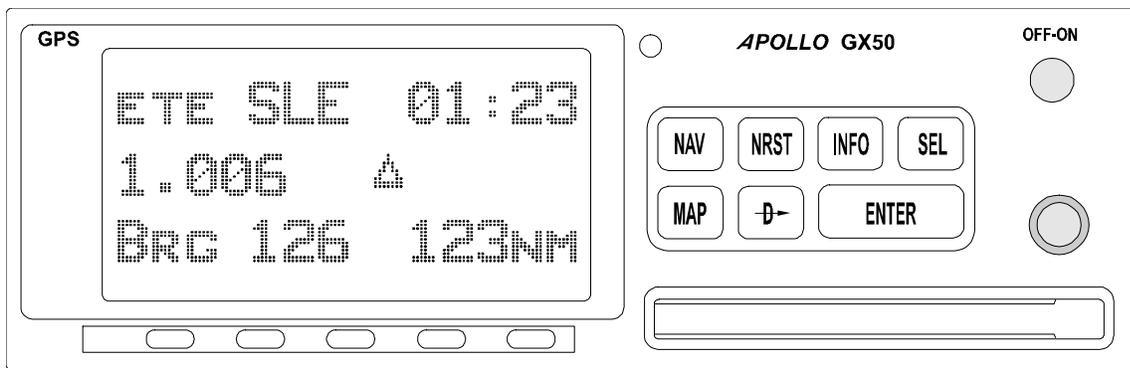


Figure 1: Apollo GX50

1.2 APOLLO GX60 GPS/COMM DESCRIPTION

The Apollo GX60 includes a 760 channel VHF communications transceiver in addition to the GPS navigation functions. The comm provides a minimum of 8 watts transmit power and receives the standard NOAA weather channels.

Two separate circuit breakers one for the GPS and one for the Comm functions power the GX60 GPS/Comm. The GX60 control panel interface (for both the navigation and the communication functions) is powered by the GX60 navigation breaker.

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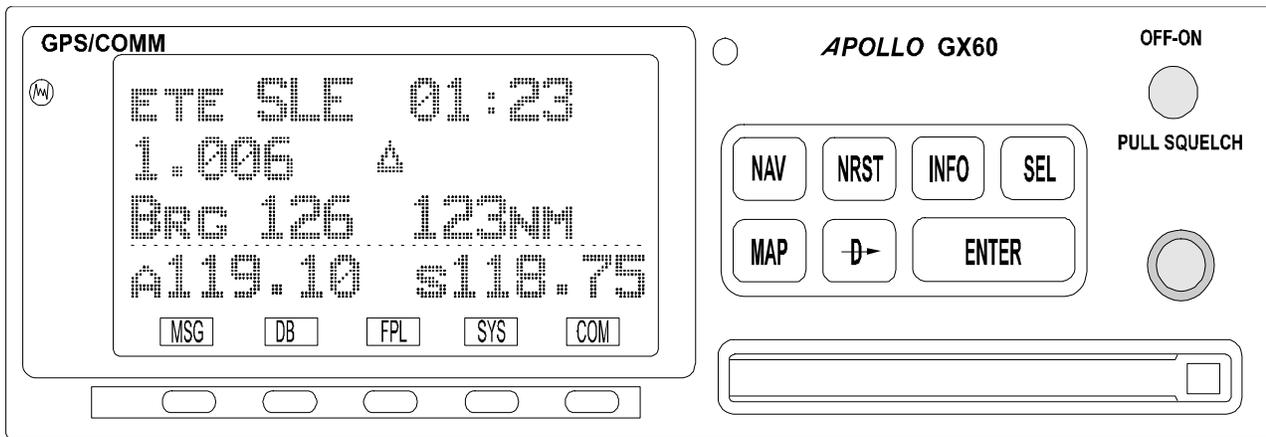


Figure 2 Apollo GX60

1.3 UAT DATALINK RADIO

The Universal Access Transceiver (UAT) is a radio datalink system supporting broadcast services. The UAT datalink is a remote mounted radio that provides this communication capability supporting aircraft-to-aircraft and aircraft-to-ground surveillance applications. These include position reports, velocity vector, intent and other relevant information about the aircraft. This type of transmission is referred to as Automatic Dependent Surveillance-Broadcast mode (ADS-B).

The UAT radio can also receive broadcasted Flight Information Services (FIS). FIS is a service that provides uplinked weather to aircraft within range of a ground transmitter.

The UAT uses two DME style antennas, one on top and one on bottom for communication.

1.4 MX20 MULTI-FUNCTIONAL DISPLAY

The MX20 Multi-Function Display (MFD) is a General Aviation in-cockpit display designed to provide the pilot with a wide variety of situational awareness related information. The display is capable of displaying ADS-B Traffic, Moving Map, Terrain Awareness information, VFR/IFR charting functions and FIS uplinked weather. Basic information displayed includes airports, navigational aids, terrain, current flight plan and more.

The MX20 includes an internal GPS sensor, which provides ownship position on the MFD and detailed positional information to the datalink radio. The MX20 uses the external GX50/60 for route information and as a backup position source. Should a condition exist, where the internal GPS sensor can not compute position or velocity, the MFD will transition data from the external navigator and adjust the datalink message for degraded accuracy.

The MX20 can provide display and control for the UAT ADS-B system for traffic. Traffic will appear on the traffic page, and can be overlaid on the custom moving map.

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The MX20 Obstruction database includes man made obstacles greater than 250' AGL as provided by NOAA. This database is updated on a 56 day cycle on the front loading datacard with other Nav databases. Symbology similar to sectional charts shows towers and poles. Catenary support structures that support overhead transmission lines located across rivers, chasms gorges etc are depicted with a crossed symbol.

The traffic page provides a pilot selectable *Altitude Filter* to limit clutter on the screen. This filter suppresses traffic that is 2000' above or below your present altitude. Surface vehicles and aircraft targets on the ground (with ground speed less than 35kts) are always depicted in tan. These surface targets can also be filtered at 2000' AGL.

The MX20 has a built in pre-heat mode (30 seconds to 60 seconds) on each startup below 30C. During the pre-heat mode, the display will remain dark. The pre-heat mode is designed to extend the life of the LCD backlight.

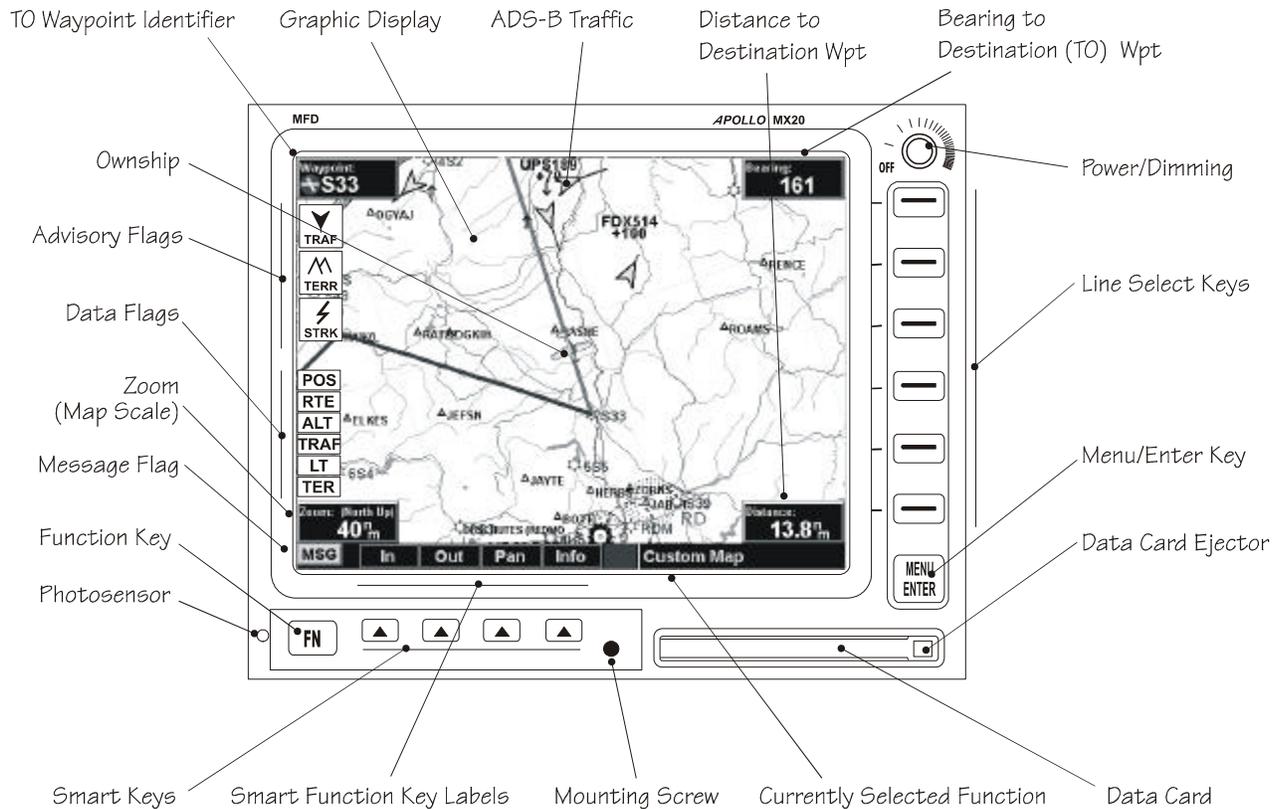


Figure 3 Apollo MX20

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2. LIMITATIONS

2.1 GX50/60 SYSTEM

2.1.1 Operational

This installation is limited to **Supplemental VFR Navigation only**

2.1.2 User Manuals

The manuals, or the information contained in the manuals listed below (or later approved versions), must be immediately available to the flight crew.

- Apollo GX Models 50, 55, & 60 User's Guide..... P/N 560-0961-02
- Apollo GX60 Comm User's Guide Insert..... P/N 560-0963-02

2.1.3 System Software

The system must utilize the software versions listed below (or later FAA approved versions). The software versions can be displayed in the system mode on the GX50/60 display.

- GX Series Nav Software Ver 3.0, 3.1, 3.2, 3.3, 3.5
- GPS Sensor Software Ver 2.3, 2.5
- VHF Comm Radio Software Ver 2.0, 2.1

2.1.4 Alternate Navigation System

The aircraft/pilot must have other navigation capability appropriate to the route of flight.

2.1.5 Magnetic Variation

- a) If the "USING MANUAL MAGVAR" message is generated by the Apollo GX50/60, the pilot/crew must verify or set manual magnetic variation to the appropriate value.

Note: The automatic magnetic variation (MagVar) correction is not available in the Apollo GX50/60 GPS above 73° North or below 73° South latitude. All bearing and track information is computed and displayed relative to true north in these polar regions.

2.1.6 Non-Navigation Information

All non-navigation information displayed by the GX50/60, such as timer/clock and waypoint information (frequencies, runways, approach plates, etc.) is advisory information only.

2.1.7 Foreign Airspace

FAA approval of the Apollo GX50/60 does not constitute approval for use in foreign airspace.

2.1.8 Placards

Aircraft will have placards identifying each of the following circuit breakers: GPS and COMM. Placards will be placed directly adjacent to the respective breaker. The instrument panel will be placarded as follows "GPS and MFD limited to VFR use only." This placard will be located close to the GPS and MFD units.

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2.2 MX20 MULTI-FUNCTION DISPLAY

2.2.1 Operational

All information displayed on the MX20 is non-required, advisory information only.

2.2.2 User Manuals

The manual or the information contained in the manual listed below (or later approved revisions), must be immediately available to the flight crew.

- Apollo MX20 Multi-Function Display User Guide.....P/N 560-1026-05 Rev A
- OR -
- Apollo MX20 Multi-Function Display User Guide.....P/N 560-1026-05
With Version 4.1 SupplementP/N 561-1077-01
- OR -
- Apollo MX20 Multi-Function Display User Guide.....P/N 560-1026-02
With Version 2.3 SupplementP/N 561-1070-00
- OR -
- Apollo MX20 Multi-Function Display User Guide.....P/N 560-1026-01
With Version 2.2 SupplementP/N 561-0271-00
- OR -
- Apollo MX20 Multi-Function Display User Guide.....P/N 560-1026-00
With Version 2.0 SupplementP/N 560-1039-00
and Version 2.2 SupplementP/N 561-0271-00

2.2.3 System Software

The system software resides on the front loading datacard. The front loading datacard must be inserted into the unit for operational use and not removed during flight. The system must utilize the software version listed below (or later FAA approved versions). The software version can be displayed in the system mode on the MX20 display under the INFO smart key.

- MX Software Ver 2.2, 2.3, 4.1

2.2.4 Terrain Function

Navigation, terrain and obstacle separation must NOT be predicated upon the use of the terrain function. The MX20 is not authorized to provide terrain separation. The terrain function is limited to the state of Alaska. Outside the state of Alaska, the terrain data will not be available and the terrain function will be flagged. A MSG at startup will verify the “Unit configured for Special

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Terrain Mode”. The MX20 internal terrain function is not TSO approved and does not provide TAWS-equivalent functionality.

Operations at extreme cold temperatures, for example, -30 degrees Celsius, will result in a significant reduction in terrain clearance provided by the terrain alerts. The MX20 prompts the pilot to enter a barometric correction every 30 minutes.

2.2.5 Weather – FIS Uplinked

Weather avoidance must NOT be predicated upon the use of the Weather or FIS function. The MX20 is not authorized to provide weather avoidance. The pilot must always receive a weather report from an FAA approved source prior to departure.

The weather function is limited to line-of-sight reception from the ground sites located across the Yukon-Kuskokwim delta. Text FIS data will be time stamped and NexRad graphical images will timeout after 20 minutes.

Graphical Nexrad images will be presented in 6 colors (light green, dark green, yellow, amber, red and magenta in order of increasing intensity). Areas with no data available will be depicted in a cyan (light blue) checkerboard pattern.

2.2.6 Traffic Function

Traffic separation must NOT be predicated upon the use of the traffic function. The MX20 is not authorized to provide traffic separation.

2.2.7 Power on Self Test (POST)

The Apollo MX20 performs a self test that the pilot is responsible for reviewing. The MX20 will self test the following functions, which require the following pilot actions:

Self Test - FAIL	Pilot Action
MX20 Program	Turn MX20 power off
Configuration files	Turn MX20 power off
NavData	Turn MX20 power off
Terrain data	Turn MX20 power off
Geography	Turn MX20 power off
Obstruction files	Turn MX20 power off
Safety Monitor	Turn MX20 power off

2.2.8 GPS function

The Capstone system includes a GPS signal splitter between the antenna and the GX50/60 navigator. The antenna pre-amplifier requires the GX to be turned on in order for the MX20 to receive GPS signals.

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2.2.9 Magnetic Variation

The automatic magnetic variation (MagVar) correction is not available in the Apollo MX20 above 73° North or below 73° South latitude. All bearing and track information is computed and displayed relative to true north in these polar regions.

2.2.10 Placard

Placard the aircraft panel, on or near the MX20, with the following placard “GPS and MFD limited to VFR use only”. Aircraft will have a placard identifying the MFD circuit breaker. Placard will be placed directly adjacent to the respective breaker.

2.3 UAT DATALINK

2.3.1 Operational

The UAT Datalink is an approved data source for Air Traffic Control ADS-B Surveillance. Operation of the datalink radio is limited to the state of Alaska. Operation of the datalink radio is also authorized in other FAA ADS-B demonstration areas. When operating outside of these areas the UAT datalink shall be turned off. This can be accomplished by setting the broadcast mode of the MX20 to “STBY” on the traffic page.

2.3.2 Placard

Aircraft will have a placard identifying the UAT circuit breaker. Placards will be placed directly adjacent to the respective breaker.

3. EMERGENCY / ABNORMAL PROCEDURES

3.1 EMERGENCY PROCEDURES

No change. Refer to approved Airplane Flight Manual.

3.2 ABNORMAL PROCEDURES

No change. Refer to approved Airplane Flight Manual.

4. NORMAL PROCEDURES

4.1 GX50/60 SYSTEM

4.1.1 General

The normal operating procedures for the Apollo GX50/60 are included in the Apollo GX Models 50, 55, & 60 User's Guide listed in the Limitations section on page 7.

4.1.2 System Switches / Controls

a) Power/Volume/Squelch Knob

The knob on the top right side of the GX50/60 controls power on/off, volume, and squelch test.

b) Large and Small Knobs

The dual concentric knobs are on the right side of front panel. The large knob moves the cursor and the small knob changes the character.

c) Hard Keys

The hard keys are the easy touch black keys with white lettering on the right side of the display. These keys include NAV, NRST (nearest waypoint), INFO, SEL (Select), MAP, Direct TO and ENTER.

d) Smart Keys

The smart keys provide custom control for specialized functions. The five small keys are located below the display. The operation of these keys will vary depending on the operational mode.

4.1.3 System Annunciation

a)MSG This is displayed on the lower left corner of the display. Message annunciation will flash when a new message is provided. Press the MSG Smart key to obtain the message. Press the smart key again to return to previous mode.

4.1.4 GX50/60 Display

a) Messages and all other available information as described in the Apollo GX User's Manual, such as distance to waypoint, groundspeed, time to waypoint, and waypoint and flight plan information, are available on the Apollo GX50/60 front panel display. The navigation information displays and sequencing rate is user-programmable. The display can also display a moving map function as described in the Apollo GX User's Manual.

4.2 MX20 MULTI-FUNCTION DISPLAY

4.2.1 General

The normal operating procedures for the Apollo MX20 are included in the User Guide listed in the

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Limitations section on page 8. The pilot shall review and clear all messages after power up.

CAUTION

It is recommended to view all functions in the Track-UP mode to avoid disorientation when transferring to the Traffic page.

4.2.2 System Switches / Controls

a) Power/Brightness

The power/brightness control is on the upper right corner of the MX20. Pulling out this knob will allow for the brightness to be controlled manually.

b) Function Key **FN**

The function key is located on the lower left corner of the MX20. The function key allows the user to scroll through the available functions.

c) Smart Function Option Keys

The soft keys along the bottom allow for selection of the function as identified directly above it or perform commonly used actions within a function.

d) Menu/Enter Key

The Menu /Enter key is located on the bottom right hand corner of the MX20. Press the Menu/Enter key to show a menu of options to modify the display of the current function. Press the Menu/Enter key again to hide the menu. The Menu/Enter key is also used to confirm entry when user input is required.

e) Line Select Keys

The line select keys are on the right hand side of the MX20. These keys are activated by the Menu/Enter Key. The keys control the various options available to the user.

4.2.3 Display Annunciators

These annunciators are displayed on the lower left hand side of the MX20.

- a) "POS" (Amber) No valid position information is available from the source. Do not expect a valid position representation on the maps. The Ownship symbol will have an "X" through it.
- b) "RTE" (Amber) No valid route (flight plan) is available from the external navigation source. Route (Flight plan) information will not be shown on the maps.
- c) "ALT" (Amber) No valid altitude information is available from the external source. Altitude related functions will not operate, such as terrain awareness.

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- d) “TRAF” (Amber) No traffic information is received from the external source. Traffic will not be displayed. Your position information will not be broadcast in ADS-B capable systems.
- e) “TER” (Amber) Terrain coverage is not available for some part of the terrain advisory coverage area. Terrain advisories may not be provided.
- f) “MSG” (Amber) Indicates a message is available on the message page.

4.2.4 Advisory Indications

These are displayed on the upper left hand side of the MX20.

- a) Traffic Advisory The traffic advisory flag will appear on the left side of the display when traffic is reported to be within +/- 2000 feet of your altitude and 5 nm of your location. The traffic advisory and traffic functions are only available when the ADS-B system is installed.
- b) Terrain Advisory The terrain advisory flag will appear on the left side of the display when the terrain surface altitude or an obstruction is within approximately 500 feet of your altitude and within approximately two minutes of flight in any direction.

4.2.5 Display Information

This display is capable of displaying various functions and many various types of information. This is detailed out in the MX20 Users guide.

4.2.6 Terrain Awareness

For all terrain functions, it is necessary that the aircraft altitude encoder be calibrated on a bi-annual basis. Terrain that is closer than 2000 feet below the aircraft, or any terrain that is above the aircraft, and is within the horizontal range of the MX20, will be displayed.

Color variations are used to show terrain heights relative to the aircraft, as follows:

RED	Terrain is at or above your current altitude.
YELLOW	Terrain that is within 500 feet of your current altitude.
GREEN	Terrain that is within 2000 feet of your current altitude.
BLACK	Terrain is greater than 2000 feet below your current altitude.
LT BLUE	NO terrain data is available

Red Terrain is also displayed on a small “Thumbnail” view provided in the upper right corner of the display for v4.1 and higher. See the MX20 User’s Guide for additional information.

4.2.7 Traffic Function

The traffic advisory flag will flash for the first 10 seconds when an ADS-B transmitting aircraft (traffic) is within 5 nm and an altitude band of +/- 2000 ft (traffic annunciation zone) of your aircraft. The traffic advisory flag will stay illuminated until the traffic aircraft is no longer within the traffic annunciation zone.

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NOTE

If an aircraft is within the traffic advisory “zone” and another aircraft enters the zone, the traffic advisory flag will not flash, but will stay illuminated until all aircraft have left the zone.

Traffic is presented by either an arrow (pointed) or a bullet (rounded) shaped target. The arrow target indicates a higher accuracy associated with the traffic’s location. Whereas the bullet indicates a degraded target. These targets can be either a cyan (light blue) or tan color depending on their speed. Tan targets are traveling slower than 35 kts. Next to the traffic is the traffic identifier and altitude. A temporary duplicate target identifier will be observed if the target aircraft changes to the “VFR anonymous” mode. The duplicate aircraft will extinguish within 10 seconds of switching the VFR mode selection.

Traffic provided over the datalink from RADAR based surveillance (TIS-B) will be depicted by a cyan (light blue) bullet shaped object pointed in the direction of travel. TIS targets act and behave similar to actual ADS-B traffic targets except that a rounded nose identifies the target. Ground based RADAR limitations in remote or mountainous terrain will not permit all traffic to be uplinked at all times.

A traffic filter can be enabled that filters targets outside of a +/- 2000 foot vertical range. The traffic page display will change from “ALL” to “+/- 2000” in the upper left corner to signify the altitude filter’s range.

4.2.8 Emergency/Services Function

The MX20 permits the pilot to broadcast a set of messages that include IDENT, general emergency, medical emergency, low fuel, no communication, and hijacking. Monitoring of these messages by Air Traffic Control is currently not available. Future enhancements of the National Airspace System will enable ATC to monitor these messages.

5. PERFORMANCE

No change.