FAA Approved Supplementary Airplane Flight Manual
II Morrow Apollo GX55 GPS

Airplane Make: Piper.....
Airplane Model: PA28-140.....
Airplane Serial No.: 28-7225092.....
Registration No.: N4203T.....

This Flight Manual Supplement must be attached to or with the FAA approved Flight Manual when the Apollo GX55 GPS is installed for IFR use in accordance with FAA Form 337 dated _____ .

The information contained herein supplements the 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 Airplane Flight Manual.

FAA Approved: _____
Title: _____
Office: _____
Federal Aviation Administration

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1. GENERAL

1.1. APOLLO GX55 GPS DESCRIPTION

The Apollo GX55 GPS is a TSO-C129 CLASS A2 GPS. It provides for connection to an external annunciator/switch array. The Apollo GX55 GPS can drive a dedicated display such as a CDI/HSI, or it can be coupled to a shared HSI/CDI and autopilot system using navigation source selectors and annunciators. The Apollo GX55 GPS is authorized for IFR/VFR en route oceanic and remote, en route domestic, and terminal operation.

The Apollo GX55, if GPS software is version 2.3 (or later FAA-approved version), meets all requirements for RNP-5/B-RNAV operations in accordance with FAA AC 90-96 and JAA TGL No. 2 revision 1 (or later).

The GX55 is a TSO-C129 Class A(2) supplemental navigation system. It interfaces to a non-numeric display (CDI/HSI) and annunciators. It is powered through the aircraft circuit breaker panel and the avionics switches. It also provides an internal moving map display.

1.1.1. GX55

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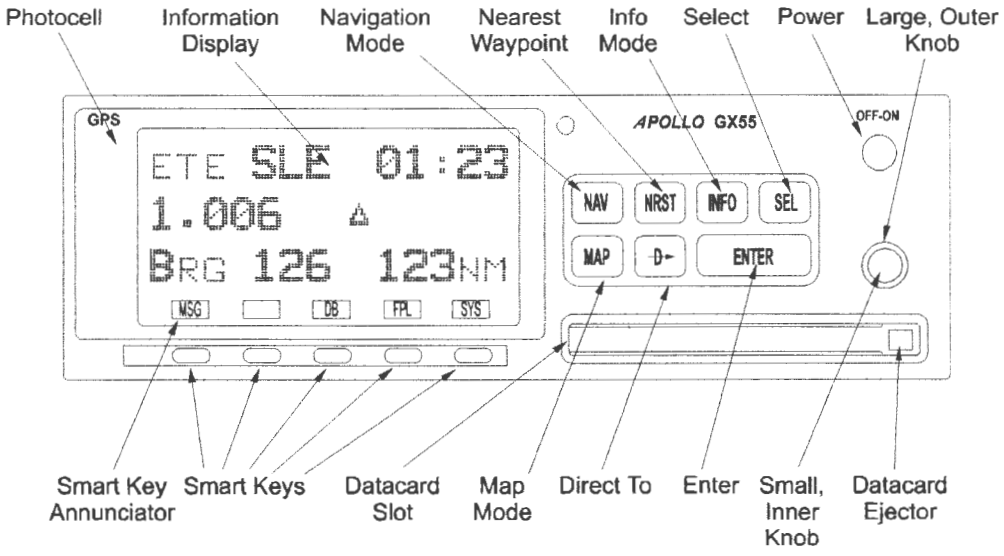

Figure 1: Apollo GX55

1.2. OPERATION

Provided the Apollo GX55 GPS is receiving adequate useable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

- VFR/IFR en route oceanic and remote, en route domestic, and terminal operation using GPS within the U.S. National Airspace System and the North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33.
- RNP-5/B-RNAV Operations as defined in AC 90-96 & JAA TGL 2 (requires GPS software version 2.3 or later FAA-approved version).

2. LIMITATIONS

2.1. USER MANUAL

The manuals, or the information contained in the manuals listed below (or later FAA-approved revisions), must be immediately available to the flight crew whenever navigation is predicated on the Apollo GX55 system.

Nav Software Version 1.0

- Apollo GX Model 55 User's Guide.....P/N 560-0962-00

Nav Software Version 2.1

- Apollo GX Models 50, 55, & 60 User's Guide .....P/N 560-0961-00

Nav Software Version 2.2

- Apollo GX Models 50, 55, 60, & 65 User's Guide ...P/N 560-0961-01

Nav Software Version 3.0

- Apollo GX Models 50, 55, 60, & 65 User's Guide ...P/N 560-0961-02

2.2. SYSTEM SOFTWARE (IFR)

The System must utilize the software version listed below (or later FAA approved versions). Versions can be displayed in the System mode on the GX55 GPS front panel.

- Apollo GX55 GPS Nav Software..... Ver 1.0, 2.1, 2.2, or 3.0 (139-0235-030)
- GPS Sensor Software ..... Ver 2.1 or Ver 2.3

2.3. DATA BASE (IFR)

IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

2.4. ALTERNATE NAVIGATION SYSTEM

The aircraft must have other approved navigation equipment installed and operational appropriate to the route of flight.

2.5. MAGNETIC VARIATION

a) The magnetic variation (MagVar) correction is not available in the Apollo GX55 GPS above 73 degrees North or below 73 degrees South latitude. All bearing and track information is computed and displayed relative to true north in these polar regions.

b) If the "Using Manual MAG VAR" message is generated by the Apollo GX55 GPS, the Pilot/Crew must verify or set the manual magnetic variation to the appropriate value.

2.6. ANNUNCIATED MESSAGES (IFR)

All annunciated messages, indicated by the MSG annunciator, must be viewed and acknowledged by the pilot/crew.

2.7. DISPLAY/ANNUNCIATORS/INDICATORS (IFR)

Prior to IFR flight, the GX55 GPS display and all annunciators and CDI/HSI indicators must be checked for proper operation. (**Note:** The GX55 GPS automatically sequences through a series of start-up tests that include operational checks of the display, annunciators, flags, and CDI/HSI indicators.)

2.8. NON-NAVIGATION INFORMATION

All non-navigation information displayed by the GX55 GPS, such as timer/clock and waypoint information (frequencies, runways, etc.) is advisory information only.

2.9. FOREIGN AIRSPACE

FAA approval of the Apollo GX55 GPS does not necessarily constitute approval for use in foreign airspace.

2.10. RNP-5/B-RNAV OPERATIONS

If 22 or fewer GPS satellites are projected to be operational for the flight, then RAIM detection availability for the flight must be confirmed using II Morrow Mission Planning Software, P/N 139-0240-012 and Mission Planning for Windows User's Guide 560-0177-00 (or later FAA-approved revisions).

3. EMERGENCY/ABNORMAL PROCEDURES

3.1. EMERGENCY PROCEDURES

No change. Refer to approved Airplane Flight Manual.

3.2. ABNORMAL PROCEDURES

3.2.1. Invalid Nav Data

If the Apollo GX55 GPS navigation information is not available or is invalid (flagged), utilize remaining operational navigation equipment as required.

3.2.2. RAIM Not Available

If a "RAIM Not Available" message is displayed, continue to navigate using the GPS equipment or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using visual reference or another IFR-approved navigation system.

4. NORMAL PROCEDURES

4.1. GENERAL

The normal operating procedures for the Apollo GX55 GPS are outlined in the Apollo GX55 GPS User's Manual listed under Limitation 1.

4.2. SYSTEM ANNUNCIATORS

A 21/4" CDI is located on the left side of the main instrument panel, within the pilot's primary instrument scan This CDI contains both the PTK and MSG annunciators. Brightness control is achieved by the main bus lighting rheostat.

4.2.1. MSG (amber)

The MSG annunciator is illuminated to indicate messages are still active. The annunciator flashes to indicate a new message that has not been viewed.

4.2.2. PTK (blue)

The PTK annunciator is illuminated when parallel track offset is in use.

Figure 2: Apollo GX55 GPS Annunciators

4.3. SYSTEM SWITCHES/CONTROLS

The switches and controls for the GX55 GPS system include the navigation source selector switches (described in section 4.5), and the controls on the front panel of the GX55 GPS (described in the Apollo GX55 GPS User's Manual).

4.4. PILOT'S DISPLAY

a) The primary navigation display for the GX55 GPS is the HSI/CDI located in the pilot's primary instrument scan area as are the system annunciators. Cross-track deviation, to/from indication, and validity are displayed on the HSI/CDI. Valid flag outputs are provided for the cross-track deviation.

b) Messages and all other available information as described in the Apollo GX55 GPS operating manual such as distance to waypoint, ground speed, time to waypoint, and waypoint and flight plan information are available on the Apollo GX55 GPS front panel.

4.5. AUTOPILOT COUPLED OPERATION - NAV SOURCE SELECTION

The installation allows for pilot selection of the navigation source for coupling to the autopilot. The available sources that can be selected are:

- NAV1
- GX55

The procedure for selecting the navigation source is as follows:

4.5.1. To select NAV1

Turn the switch labeled "GPS / NAV1" so that "NAV1" is selected.

4.5.2. To select GX55 GPS

Turn the switch labeled "GPS / NAV1" so that "GPS" is selected.

For autopilot operation, refer to the autopilot operator's manual.

4.6. TO/FROM "OBS" SELECTION

When waypoint sequencing is suspended a desired course to or from the active waypoint can be selected by pressing the Direct-to key twice, entering the course with the large and small knobs, and pressing enter. Selecting a desired "OBS" to/from course when sequencing is not suspended will automatically suspend sequencing.

4.7. RAIM

RAIM stands for Receiver Autonomous Integrity Monitor. It provides a method whereby the receiver can provide an integrity check, using more satellites than are needed for a position solution. This integrity check protects you from position errors caused by failed satellites or bad GPS satellite data. RAIM is based on an allowed

limit of horizontal position difference called the RAIM alarm limit. Two different RAIM limits are used in the Apollo GX55 GPS corresponding to the phase of flight:

4.7.1. En route RAIM (2.0 nm.)

En route RAIM alarm limit is 2.0 nm. During the en route phase of flight a RAIM alarm will mean that an error of 2.0 nm. or greater, caused by bad satellite data, has been detected.

4.7.2. Terminal RAIM (1.0 nm.)

Terminal RAIM alarm limit of 1.0 nm is automatically provided by the Apollo GX55 GPS when you are within 30 nm. radial distance of your departure or destination airport as contained in the active flight plan.

4.8. PARALLEL TRACK

When the parallel track feature (PTK) is activated, navigation is predicated on a course offset from the parent route by the selected parallel track distance. The PTK annunciator will be continuously on when the PTK feature is active. All navigation data, such as bearing and distance to active waypoint, is calculated and displayed relative to the "phantom" active waypoint parallel to the actual waypoint. Use of the Direct-to feature or entering a desired "OBS" course relative to the active waypoint automatically cancels PTK and extinguishes the PTK annunciator. When PTK is in use, the route line drawn on the moving map display represents the parallel course.

The Apollo GX55 will not allow the activation of the parallel track feature if the active flight plan has a future turn of more than 120 degrees or if a flight plan "doubles back" with a series of turns all less than 120 degrees and that would cause the parallel offset course to overlap itself.

4.9. AIRSPACE ALERTS

Airspace alerts [set under MAP Mode - Airspace Setup] should be set to "OFF" for IFR operations to prevent unnecessary airspace alert messages.

5. PERFORMANCE

No change. Refer to the approved Airplane Flight Manual.

6. WEIGHT AND BALANCE

Refer to the current aircraft weight and balance information.

7. SYSTEM DESCRIPTION

The Apollo GX55 GPS **is a TSO C129 A2 GPS navigation system. The GX55 GPS system is installed using the guidelines of AC 20-138. The GX55 GPS system is illustrated in**

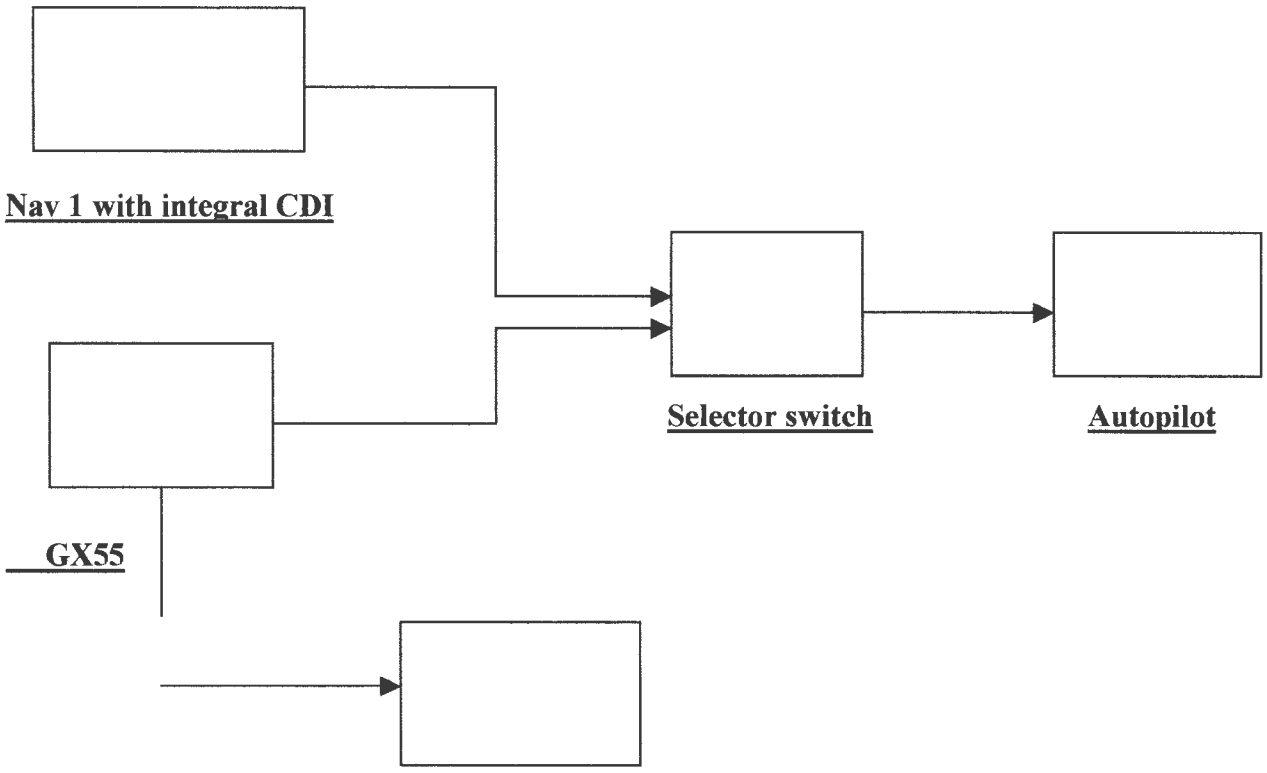

Figure 3: GX55 Navigation System Block Diagram

7.1. APOLLO GX55 GPS SYSTEM COMPONENTS

The GX55 system derives GPS position from an internal receiver, using a roof-mounted antenna. Altitude information is derived from an ACK-30 blind encoder which sends Gray coded signals to a Transcal SSD serialiser. This unit converts Gray code to a serialized data string which is passed to the GX55.

GX55 annunciators, flags and CDI output are sent to a Mid-Continent 2 ¼" CDI.

The GX55 autopilot output is connected to the autopilot via a selector switch, facilitating selection of either GPS or Nav source signal.

7.1.1. Apollo GX55

The **Apollo GX55 GPS** is the main control, display, and navigation computer for the Apollo GX55 GPS system. The GX55 GPS also includes outputs and drivers for connection to external CDI/HSI indicators, autopilots, and system annunciators. The database for the GX55 GPS is contained on a user replaceable database card. Data is available on the standard AIRAC 28-day update cycle.

7.1.2. Circuit Protection

Circuit protection is separately provided for the GX55 and the CDI by means of 14vdc 1 amp pull type circuit breakers, inserted at the main bus.

7.2. NAVIGATION SOURCE SELECTION

Described in Section 4.

7.3. APOLLO GX55 GPS OPERATION

This section highlights several of the basic operational features of the Apollo GX55 GPS. Refer to the user manual listed in Limitation 1 for complete operating instructions.

7.3.1. Basic Navigation Data

The basic navigation data can be selected on the GX55 GPS display by pressing the NAV button (twice), then rotating the SMALL knob to view the navigation pages. The basic navigation data available includes:

- Bearing and distance to the next waypoint
- Cross track error bar graph and numeric display
- Ground speed and track angle
- ETE (estimated time en route) to the next waypoint

7.3.2. Viewing Messages

To view messages, press the MSG button, rotate the LARGE knob to select "new" or "old" messages, and rotate the SMALL knob to view the messages.

The MSG annunciator is illuminated when there are active messages, flashing when there are new messages. "Old" messages are those messages that have already been viewed as a "new" message.

7.3.3. Direct To -

7.3.3.1 Waypoint Entry

To enter a waypoint as the next waypoint, press the DIRECT-TO button, rotate the LARGE and SMALL knobs to select the desired waypoint, and press ENT.

7.3.3.2 "OBS" Entry

To enter a bearing to or from the active "To" waypoint, press the DIRECT-TO button twice, rotate the LARGE and SMALL knobs to select the desired course, and press ENT. If waypoint sequencing was not already suspended, entering a to/from bearing will automatically suspend sequencing.

Note: When you cross a waypoint the first time when sequencing is suspended, a message will be generated to remind you to enter the desired inbound course for your hold. This message will ask you to press ENT to enter your inbound course or any other key to ignore the message. Pressing ENT when this message is displayed will result in displaying the course entry page, just as if you had pressed Direct-To button twice.

7.3.4. Moving MAP

To display a moving map, press the MAP KEY. In the Map mode, the large knob selects the map display and setup pages. The small knob changes the map scale on the map display pages. In the MAP mode, the "smart keys" are used to change the display of waypoint types. Each key is identified by a waypoint type, e.g. Airport, VOR,... Pressing the button or "smart key" under each waypoint type will result in changing the display selection for that waypoint type. There are three display selections: Off, waypoints only, and waypoints with identifiers.

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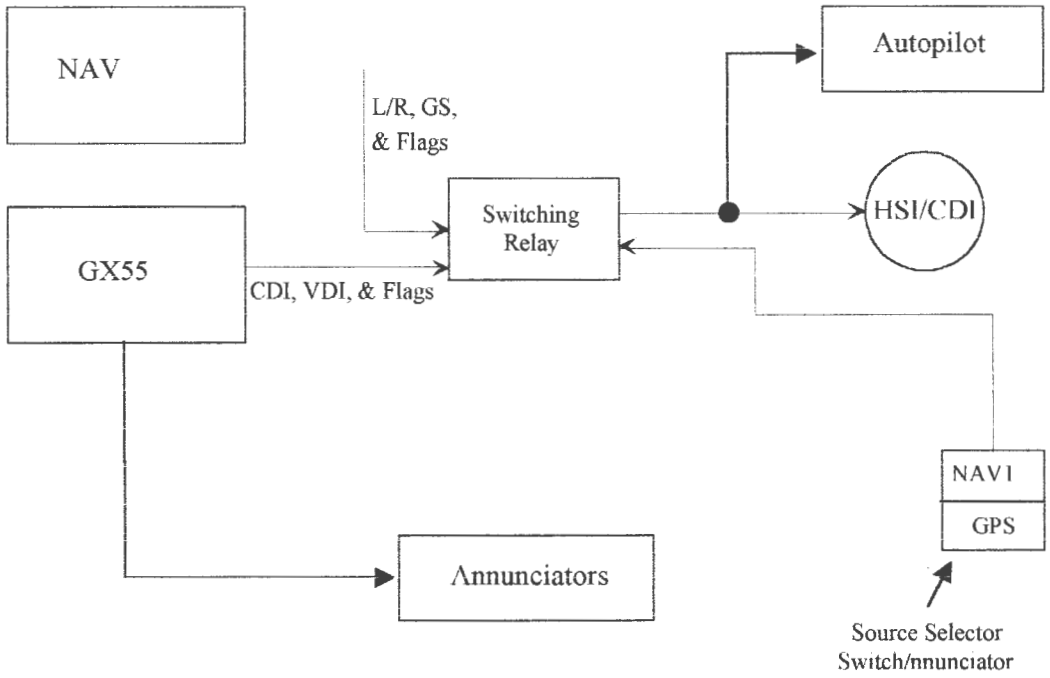

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(Modify figure 3 as necessary to describe the installation)

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