SUPPLEMENT 5

TO THE AIRPLANE FLIGHT MANUAL (AFM)

DA42 L360

G1000 SYNTHETIC VISION TECHNOLOGY

Doc. No.	: D42L-AFM-002
Date of Issue	: 28 February 2012

Signature :

Authority :

> CANADA
> **DEPARTMENT OF TRANSPORT**
> **AIRCRAFT CERTIFICATION**
> **BRANCH**
> JUIL / JUL 1 9 2012
> **APPROVED**
> BY: *Thomas E Bull*
> CERT/ISSUE NO. SA09.54, 31. 2

Date of Approval :

This Flight Manual Supplement 5 has been verified by the Transport Canada Civil Aviation (TCCA) Authority as primary certification authority in accordance with the valid certification procedures and is approved.

Intentionally left blank

LIST OF EFFECTIVE PAGES

Chapter		Page	Date
Cover Page	DOT-approved	9-S5-1	28-Feb-12
	Blank Page	9-S5-2	28-Feb-12
LOEP		9-S5-3	28-Feb-12
		9-S5-4	28-Feb-12
TOC		9-S5-5	28-Feb-12
	Blank Page	9-S5-6	28-Feb-12
1		9-S5-7	28-Feb-12
		9-S5-8	28-Feb-12
		9-S5-9	28-Feb-12
	Blank Page	9-S5-10	28-Feb-12
2	DOT-approved	9-S5-11	28-Feb-12
	DOT-approved	9-S5-12	28-Feb-12
3	DOT-approved	9-S5-12	28-Feb-12
4A	DOT-approved	9-S5-13	28-Feb-12
	DOT-approved	9-S5-14	28-Feb-12
	DOT-approved	9-S5-15	28-Feb-12
	DOT-approved	9-S5-16	28-Feb-12
	DOT-approved	9-S5-17	28-Feb-12
	DOT-approved	9-S5-18	28-Feb-12
	DOT-approved	9-S5-19	28-Feb-12
	Blank Page	9-S5-20	28-Feb-12
4B	DOT-approved	9-S5-21	28-Feb-12
	Blank Page	9-S5-22	28-Feb-12

LIST OF EFFECTIVE PAGES (Continued)

Chapter		Page	Date
5	DOT-approved	9-S5-23	28-Feb-12
6	DOT-approved	9-S5-23	28-Feb-12
	Blank Page	9-S5-24	28-Feb-12
7		9-S5-25	28-Feb-12
		9-S5-26	28-Feb-12
		9-S5-27	28-Feb-12
		9-S5-28	28-Feb-12
		9-S5-29	28-Feb-12
		9-S5-30	28-Feb-12
8		9-S5-31	28-Feb-12
	Blank Page	9-S5-32	28-Feb-12

CHAPTER 9

SUPPLEMENT 5

G1000 SYNTHETIC VISION TECHNOLOGY SUB-SYSTEM

TABLE OF CONTENTS

Intentionally left blank

1. GENERAL

1.8 G1000 AVIONICS SYSTEM

SYNTHETIC VISION TECHNOLOGY

This document describes the Synthetic Vision Technology (SVT) which is an optional part of the Garmin G1000 Integrated Avionics System. This information supplements the information presented in the Airplane Flight Manual.

The purpose of the SVT sub-system is to assist the pilot in maintaining situational awareness with regard to the terrain and traffic surrounding the airplane and the navigational situation relative to the programmed flight plan. A typical SVT display is shown below.

SVT Display

SVT provides additional features on the G1000 primary flight display (PFD) which displays the following information:

- Synthetic Terrain; an artificial, database derived, three dimensional view of the terrain ahead of the airplane within a field of view of approximately 30 degree left and 35 degree right of the airplane heading.

- Obstacles; obstacles such as towers, including buildings higher than 200 ft above ground level that are within the depicted synthetic terrain field of view.

- Flight Path Marker (FPM); an indication of the current lateral and vertical path of the airplane. The FPM is always displayed when synthetic terrain is selected for display.

- Pathway; a pilot selectable three dimensional representation of the programmed flight plan path that can be selected for display alone or with the flight director anytime synthetic terrain is selected for display.

- Traffic; a display on the PFD indicating the position of other airplane detected by the Traffic Information System (TIS) component of the G1000 system.

- Horizon Line; a white line indicating the true horizon is always displayed on the SVT display.

- Horizon Heading; a pilot selectable display of heading marks displayed just above the horizon line on the PFD.

- Airport Signs; pilot selectable "signposts" displayed on the synthetic terrain display indicating the position of nearby airports which are in the G1000 database.

- Runway Highlight; a highlighted presentation of the location and orientation of the runway(s) at the destination airport.

<div align="center">

WARNING

</div>

THE SYNTHETIC TERRAIN DISPLAY IS INTENDED TO AID THE PILOT AWARENESS OF THE TERRAIN AND OBSTACLES IN FRONT OF THE AIRPLANE. IT MAY NOT PROVIDE EITHER THE ACCURACY OR FIDELITY, OR BOTH, ON WHICH TO SOLELY BASE DECISIONS AND PLAN MANEUVERS TO AVOID TERRAIN OR OBSTACLES. THE SYNTHETIC VISION ELEMENTS ARE NOT INTENDED TO BE USED FOR PRIMARY AIRPLANE CONTROL IN PLACE OF THE PRIMARY FLIGHT INSTRUMENTS.

<div align="center">

WARNING

</div>

THE PATHWAY PRESENTATION IS INTENDED ONLY TO AID THE PILOT'S AWARENESS OF THE PROGRAMMED FLIGHT PATH LOCATION RELATIVE TO THE AIRPLANE'S CURRENT POSITION.
NO VERTICAL PATHWAY INFORMATION IS PRESENTED FOR CLIMBS.

<div align="center">

NOTE

</div>

The synthetic terrain depiction displays an area approximating the view from the pilot's eye position when looking directly ahead out of the windshield in front of the pilot. Terrain features outside this field of view are not shown on the display.

Intentionally left blank

2. OPERATING LIMITATIONS

2.16 OTHER LIMITATIONS

2.16.7 GARMIN G1000 AVIONICS SYSTEM

(a) The Garmin G1000 Cockpit Reference Guide for the DA42 L360, P/N 190-01062-02 Rev A or later appropriate revision must be immediately available to the flight crew.

(b) Diamond DA42-L360 System 1054.03 appears on the MFD splash screen during startup.

NOTE

The database version is displayed on the MFD power-up page immediately after system power-up and must be acknowledged. The remaining system software versions can be verified on the AUX group sub-page 5, "AUX-SYSTEM STATUS".

USE OF THE SYNTHETIC VISION TECHNOLOGY

(a) Use of the Synthetic Vision Technology display elements alone for airplane control without reference to the G1000 primary flight instruments or the airplane standby instruments is prohibited.

(b) Use of the Synthetic Vision Technology alone for navigation, or obstacle or terrain avoidance is prohibited.

(c) Use of the Synthetic Vision Technology traffic display alone to avoid collision with other airplanes is prohibited.

3. <u>EMERGENCY PROCEDURES</u>

There is no change to the airplane emergency procedures when the Synthetic Vision Technology Sub-System is installed.

4A. NORMAL OPERATING PROCEDURES

4A.6 CHECKLISTS FOR NORMAL OPERATING PROCEDURES

4A.6.25 SYNTHETIC VISION TECHNOLOGY SUB-SYSTEM

Turn Synthetic Vision on/off

The SVT system may be turned on or off as desired.

To turn the synthetic vision system on or off:

On the PFD:

 (a) PFD key...press

 (b) SYN VIS key...press

 (c) SYN TERR key...press as desired

The synthetic vision system will cycle on or off with each press of the SYN TERR key. The Flight Path Marker is displayed anytime SYN TERR is selected for display.

Turn Pathways on/off

On the PFD:

 (a) PFD key...press

 (b) SYN VIS key...press

 (c) PATHWAY key ....press as desired

The pathway display will cycle on or off with each press of the PATHWAY key. The pathway can be displayed separately or in conjunction with the flight director.

> **NOTE**
>
> If displayed, the pathway may be quickly turned off by pressing the PFD softkey at the bottom of the PFD followed by two presses of the far left PFD soft key.

Turn Horizon Heading on/off

On the PFD:

    (a)   PFD key ....press

    (b)   SYN VIS key ....press

    (c)   HRZN HDG key..press as desired

The horizon heading display will cycle on or off with each press of the HRZN HDG key.

Turn Airport Signs on/off

On the PFD:

    (a)   PFD key ....press

    (b)   SYN VIS key ....press

    (c)   APTSIGNS key ....press as desired

The horizon heading display will cycle on or off with each press of the APTSIGNS key.

Use of Pathway

If Synthetic Terrain is displayed on the PFD, the pathway may be used to assist the pilot's awareness of the programmed lateral and vertical navigation path. The following sections describe the basic use of the pathway in various flight phases. For more detailed information, consult the G1000 Pilot's Guide.

<u>Departure</u>:

Prior to departure, load and activate the desired flight plan into the G1000 FMS, set the initial altitude on the G1000 altitude selector and select GPS on the HSI display just as you would without the SVT system.

The programmed flight path will be displayed as a series of magenta boxes along the path at the flight plan altitude subject to the following conditions;

- If the first segment of the flight plan is a heading to altitude leg, the pathway will not be displayed for that segment. The first pathway segment displayed will be the first GPS course leg.

- The pathway must be within the SVT field of view of 30 degrees left and 35 degrees right. If the programmed path is outside of that field of view, the pathway will not be visible on the display until the airplane has turned towards the course.

- The pathway will be displayed at either the altitude selected on the G1000 selector OR the altitude published for the procedure (e.g. SID), WHICHEVER IS HIGHER.

After departure, the primary airplane control must be by reference to the primary airplane instruments. The SVT and pathway displays should be used to aid in awareness of the terrain and programmed flight path.

Prior to intercepting the programmed course, the pathway will be displayed as a series of magenta "boxes" with pointers at each corner that point in the direction of the programmed course. The pathway boxes will not be displayed on portions of the course line that would lead the pilot to intercept the course in the wrong direction.

As the airplane approaches the center of the programmed course and altitude, the number of pathway boxes will decrease to a minimum of four.

<u>Enroute</u>:

When enroute, the pathway will be displayed along the lateral path defined by the flight plan, at the altitude selected on the G1000 altitude selector.

Flight plan changes in altitude that require a climb will be indicated by the pathway being displayed as a level path at the altitude entered for the current flight plan leg. Because the G1000 system has no airplane performance information, climb profiles are not displayed by the pathway.

If the programmed flight plan includes one or more defined VNAV descent segments, the descent path(s) will be displayed by the Pathway System as prompted by the G1000 FMS.

If the flight plan includes a significant change in course at a waypoint, the pathway boxes toward the currently active waypoint will be magenta in color. The boxes defining the next flight plan segment may be visible, but will be displayed in white color.

The following figure shows an example for an Enroute Pathway Altitude Display.

Enroute Pathway Altitude Display
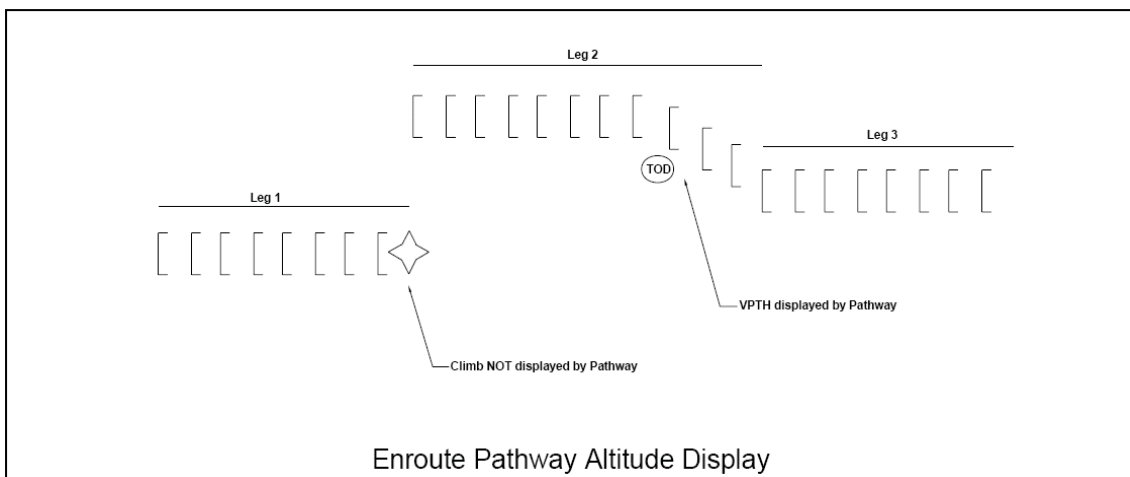
Approach:

During approach, the SVT and pathway displays should only be used to maintain awareness with regard to the surrounding terrain and the programmed flight path. Primary airplane control must be accomplished by reference to the primary flight instruments and, if desired, the flight director.

GPS approach:

During a GPS approach, the lateral path and altitude will be displayed by the pathway in magenta along each segment including the path required to track course reversals that are part of the approach procedure (such as a holding pattern). Approach descent segments will be displayed by the pathway as published in the approach procedure.

If Vectors-To-Final is selected as the approach transition, the pathway will display the final approach course inbound to the Missed Approach Point (MAP). The pathway will be shown level at the altitude set in the G1000 altitude selector, or the Final Approach Fix (FAF) crossing altitude (whichever is higher), up to the point along the final approach course where that altitude intercepts the extended VPTH or GP. If the altitude selector indicates an altitude below the airplane's current altitude, the pathway will appear below the airplane altitude and the pilot must use normal descent techniques to intercept the VPTH or GP. If the altitude selector is left at an altitude above the current airplane altitude, the airplane will intercept the final approach course below the extended VPTH or GP, such that the pathway will be displayed above the airplane until the airplane intercepts the VPTH or GP. From the VPTH or GP intercept point, the pathway will be shown inbound to the Missed Approach Point along the published lateral and vertical descent path.

ILS Approach:

When an ILS approach is programmed into the G1000 FMS, the initial approach segments will be displayed by the pathway in magenta at the procedure segment altitudes if they are being flown by reference to a GPS path. When the G1000 system switches to the localizer inbound to the final approach fix, the pathway will be displayed along the localizer inbound path and glideslope in green.

If Vectors-To-Final is selected as the approach transition, the pathway will display the final approach course inbound to the Missed Approach Point (MAP). The pathway will be shown level at the altitude set in the G1000 altitude selector, or the Final Approach Fix (FAF) crossing altitude (whichever is higher), up to the point along the final approach course where that altitude intercepts the extended GS. If the altitude selector indicates an altitude below the airplane's current altitude, the pathway will appear below the airplane altitude and the pilot must use normal descent techniques to intercept the GS. If the altitude selector is left at an altitude above the current airplane altitude, the airplane will intercept the final approach course below the extended GS, such that the pathway will be displayed above the airplane until the airplane intercepts the GS. From the GS intercept point, the pathway will be shown inbound to the MAP along the published localizer and glideslope.

VOR, LOC BC, or other Approach:

Approach segments for a VOR, LOC BC, ADF or other approach that are approved to be flown by reference to GPS will be displayed by the pathway in a magenta color. Approach segments that are defined by other than a GPS or ILS, such as heading legs or VOR defined final approach course, will not be displayed by the pathway.

Missed Approach:

When the missed approach is selected on the G1000 FMS, the pathway to the Missed Approach Holding Point will be displayed just as described for the departure segment.

The pilot must assure that the airplane path will, at all times, comply with the requirements of the published missed approach procedure.

If the initial missed approach leg is heading-to-altitude or a leg defined by other than a GPS course, the pathway will not be displayed for that segment.

If the course to the Missed Approach Holding Point is out of the SVT field of view during the initial missed approach climb, the pathway will not be visible on the PFD until the airplane is turned toward the course.

The pathway will be displayed at the published missed approach altitude OR the altitude set on the G1000 altitude selector WHICHEVER IS HIGHER. If the G1000 altitude selector is set to MDA on the final approach segment and not reset during the initial missed approach, the pathway will still be displayed at the published missed approach altitude.

Missed Approach Pathway Display
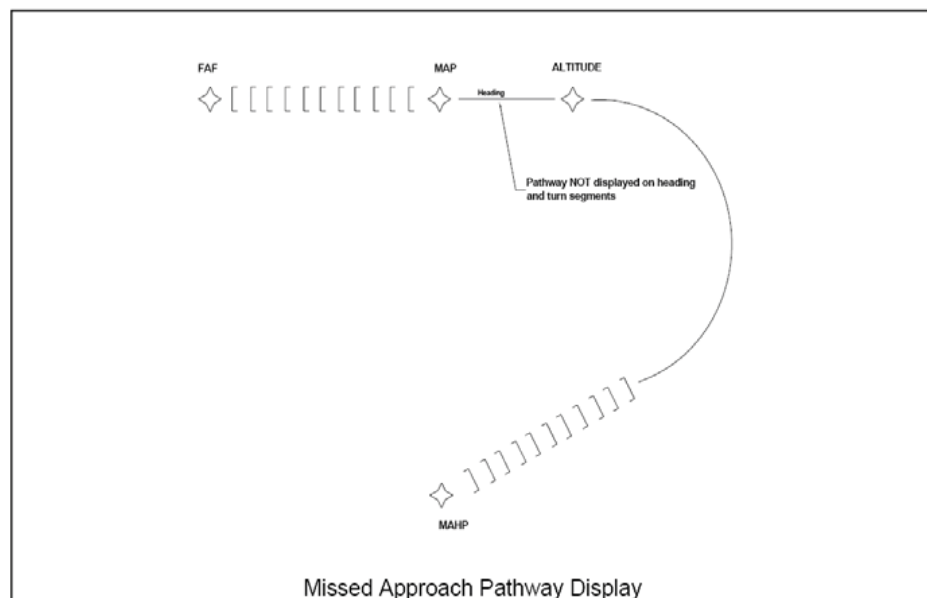
Intentionally left blank

4B. ABNORMAL OPERATING PROCEDURES

4B.9 FAILURES IN THE SYNTHETIC VISION TECHNOLOGY SUB-SYSTEM

SVT Displays information inconsistent with G1000 primary flight instrumentation

On the PFD:

    (a)   PFD key...press

    (b)   SYN VIS key...press

    (c)   SYN TERR key...press as desired

    (d)   SVT is removed from the PFD ....verify

Use G1000 primary displays for navigation and airplane control.

G1000 operation in display backup mode is required

Select display backup mode on the G1000 system.

NOTE

When display backup mode is selected, the MFD will initially present a non-SVT (blue sky over solid brown ground) display. SVT will be presented on the MFD within 20 seconds if it was enabled on the PFD when display backup was selected.

Intentionally left blank

5. <u>PERFORMANCE</u>

There is no change to the airplane performance when the Synthetic Vision Technology Sub-System is installed.

6. <u>MASS AND BALANCE / EQUIPMENT LIST</u>

There is no change to the airplane mass and balance when the Synthetic Vision Technology Sub-System is installed.

Intentionally left blank

7. DESCRIPTON OF THE AIRPLANE AND SYSTEMS

7.13 GARMIN G1000 INTEGRATED AVIONICS SYSTEM

7.13.7 SYNTHETIC VISION TECHNOLOGY SUB-SYSTEM

General

The SVT sub-system is dependent upon terrain data provided by the underlying G1000 system. If, for some reason, the terrain data is not available from the G1000, all of the components of the SVT system will be unavailable. The flight path marker, horizon heading, and airport signs are all sub-components of the Synthetic Terrain display and are only available when Synthetic Terrain is enabled. Those features are selected or de-selected using the PFD softkeys on the SVT menu.

SVT Display

Synthetic Terrain

The Synthetic (3D) Terrain display on the PFD provides a perspective view of the terrain ahead of the airplane showing ground features up to 30 degrees left and 35 degrees right of the airplane heading. The terrain display is derived from the same terrain data contained in the G1000 system that is optionally used to display terrain on the MFD map display. The terrain data has a resolution of 9 arc-seconds, this means that the terrain elevation contours in the database are stored broken down into squares 9 arc-seconds on each side. That data is processed and smoothed by the G1000 system to provide the synthetic terrain display. In some instances, terrain features such as lakes in mountainous areas may be presented by the SVT system as if the lake water extends somewhat up the mountainside. This is due to the limitations of the terrain database resolution but is not significant for the approved uses of the SVT system.

The SVT terrain display will show land contours; large water features; and, towers and other obstacles over 200 ft above ground level (including buildings), that are included in the G1000 obstacle database. In order to provide a clean, uncluttered PFD display, cultural features on the ground such as; roads and highways, railroad tracks, cities, and political boundaries (state / county lines) are not displayed on the PFD even if those features are selected for display on the MFD. The colors used to display the terrain elevation contours are similar to those used on the MFD map. The terrain display also includes a north-south, east-west grid to assist in orientation relative to the terrain.

The terrain display is intended to serve as an awareness tool only. It may not provide either the accuracy or fidelity, or both, on which to solely base decisions and plan maneuvers to avoid terrain or obstacles. Navigation must not be predicated solely upon the use of the TAWS, Terrain or Obstacle data displayed by the G1000 SVT system.

The Terrain/Obstacle/Airport databases have an area of coverage as detailed below:

- The Terrain Database has an area of coverage from North 75° Latitude to South 60° Latitude in all longitudes.

- The Airport Terrain Database has an area of coverage that includes the United States, Canada, Mexico, Latin America, and South America.

- The Obstacle Database has an area of coverage that includes the United States.

> **NOTE**

> The area of coverage may be modified, as additional terrain data sources become available.

Obstacle and Terrain Alerts and Warnings

Obstacles and terrain displayed on the SVT system may be highlighted if an alert or warning is generated by the G1000 Terrain or TAWS system. If an obstacle alert is presented for an obstacle that is in the SVT field of view, the obstacle symbol on the PFD will turn yellow in color. If an obstacle warning is generated by the G1000 system, the obstacle symbol on the PFD will turn red.

If the G1000 Terrain or TAWS system generates a terrain alert or warning, the terrain feature displayed on the PFD will be colored yellow for an alert or red for a warning for as long as the alert remains valid.

Because the area monitored by the Terrain or TAWS system can be wider than the field of view that can be displayed by the SVT system, it is possible to receive an obstacle or terrain audible alert for an obstacle or terrain that is not shown on the SVT display. In those cases, the object generating the alert will be left or right of the airplane. Refer to the other displays in the airplane to determine the cause of the message.

Flight Path Marker

The SVT display includes a green circular barbed symbol called the Flight Path Marker (FPM) that represents the current path of the airplane relative to the terrain display. The FPM is always displayed when synthetic terrain is displayed and the airplane ground speed exceeds 30 kt. The FPM indicates the current lateral and vertical path of the airplane as determined by the GPS sensor. If the FPM is above the horizon line, the airplane is climbing, and similarly if the FPM is below the horizon line, the airplane is descending. If the airplane is flying in a crosswind, the FPM will be offset from the center of the display. In that case, the center of the PFD airplane reference symbol indicates the airplane heading and the FPM indicates the direction that the airplane is actually moving, taking into account the crosswind.

The FPM indicates the current path of the airplane but does not predict the future path. If airplane attitude, power setting, airspeed, crosswind, etc. are changed, the FPM will move to indicate the new path resulting from those changes. If the FPM is below the terrain or obstacle displayed behind it on the PFD, the current airplane path will not clear that terrain or obstacle.

CAUTION

IF THE FPM IS ABOVE THAT TERRAIN OR OBSTACLE, THE AIRPLANE WILL CLEAR THE TERRAIN OR OBSTACLE IF, AND ONLY IF, THE CURRENT AIRPLANE CONFIGURATION IS MAINTAINED, AND THE AIRPLANE PERFORMANCE WILL PERMIT YOU TO MAINTAIN THE CURRENT VERTICAL (CLIMB) GRADIENT UNTIL PAST THE TERRAIN OR OBSTACLE.

Pathway

If PATHWAY is enabled on the SVT menu of the PFD and a defined navigation path has been entered on the G1000, the SVT system will display a pathway, sometimes called a "highway in the sky" or HITS. The pathway is a perspective representation of the programmed flight path. When the airplane is well off course, the pathway will be displayed as a number boxes floating in the sky along the programmed lateral and vertical path. As the airplane intercepts the programmed flight path, the number of boxes displayed will be reduced to a maximum of four to avoid cluttering the PFD display. The pathway is only displayed for navigation paths that are fully defined by the sensor in use, including GPS and ILS paths. Because a fully defined lateral and vertical path through space is not defined by them, a pathway is not displayed for heading legs, VOR, LOC, BC or ADF segments. When the pathway is displayed, the color of the boxes indicates the sensor generating the path. If the GPS sensor is in use, the boxes will be magenta colored. If the ILS sensor is defining the path in use, the boxes will be green.

The pathway boxes are +- 100 ft in vertical dimension and approximately +-380 ft horizontally from the center of the box. The pathway presentation is intended only to aid the pilot in awareness of the programmed flight path location relative to the airplane's current position. The pathway is not intended for use as a primary reference in tracking the navigation path.

If a GPS based descent profile has been programmed either on the G1000 flight plan page or as part of an approach or STAR, the descent will be displayed by the pathway. Climb paths are never displayed by the pathway. If a profile requires a climb, the pathway will be displayed as a level segment at the higher of the altitude defined by the programmed path or the G1000 altitude selector.

Traffic

If traffic that is within the SVT field of view is detected by the G1000 TIS system, a symbol will be displayed on the PFD indicating the direction and relative altitude of the traffic. The traffic will be displayed as a white diamond unless it generates a traffic alert. Traffic that causes an alert will be displayed as a solid yellow circle accompanied by a yellow TRAFFIC annunciator to the right of top of the airspeed display tape.

Horizon line

The SVT display includes an always visible white horizon line that represents the true horizon. Terrain will be presented behind the horizon line, and terrain shown above the horizon line is above the current airplane altitude. Terrain that is shown below the horizon line is below the airplane altitude.

Horizon Heading

A heading scale may be displayed on the PFD horizon line, if selected by the pilot. The heading marks are spaced in even 30 degree increments and are presented just above the horizon line with tic marks that intersect the horizon line. The horizon heading will correspond to that presented by the Horizontal Situation Indicator. Because the horizon heading is only displayed in 30 degree increments, it should only be used for general heading awareness and not be used to establish the airplane heading.

Airport Signs and runway highlight

If APTSIGNS is selected, a "sign post" along with a representation of the runways will be plotted on the SVT display for nearby airports that are contained in the G1000 airport database. The signpost will become visible when you are within approximately 15nm of the airport. The text identifier for the airport will be displayed inside the airport sign when the airplane reaches approximately 8 nm from the airport. Once the airplane reaches approximately 4.5 nm from the airport, the airport sign will be removed but the runways presentation will remain. If an approach to a specific runway has been loaded and activated, that runway will be highlighted on the SVT display.

When on an approach, the highlight for the approach runway will be considerably larger than "normal" to assist in visually acquiring the runway. The oversized highlight will automatically shrink around the runway depiction so that the runway is proportionally displayed when the airplane is within approximately ½ nm of the threshold. Runway highlighting is displayed even if APTSIGNS are turned off.

8.   <u>AIRPLANE HANDLING, CARE AND MAINTENANCE</u>

There is no change to the airplane handling, care or maintenance when the Synthetic Vision Technology Sub-System is installed.

Intentionally left blank