PREPARED	PIPER AIRCRAFT CORP. DEVELOPMENT CENTER, VERO BEACH, FLA	
CHECKED		
APPROVED	REPORT VB-163	PAGE

DUPLICATE

AIRPLANE FLIGHT MANUAL

MODEL PA-28-180

SERIAL NOS. 671 THRU 5600

FAA IDENTIFICATION NO. _____

SERIAL NO. 28-4289

THIS DOCUMENT MUST BE KEPT IN AIRPLANE AT ALL TIMES.

FAA APPROVED: Original signed by Walter R. Haldeman *
Walter R. Haldeman
Chief, Engineering & Manufacturing Branch
Southern Region - - - Atlanta, Georgia

DATE: August 3, 1962

FAA APPROVED: Gene Dearing For Retype Only.
Gene Dearing
Aerospace Engineer

DATE: August 12, 1964

Log of Revisions

REVISION NO.	PAGE	DESCRIPTION	APPROVED	DATE
1	1	Deleted Propeller Pitch Information. Added Static R.P.M. Information	for H. E. Waterman Supervisor SO-EMDO-42	5/25/64
2	2	Placards Section: Added Placard No. 5	H. E. Waterman Supervisor SO-EMDO-42	7/8/64
3	2	Added to Placard No. 3: "BAGGAGE, MAX. 200 LBS., SEE WEIGHT AND BALANCE DATA FOR BAGGAGE LOADINGS BETWEEN 150 LBS. AND 200 LBS."	for H. C. Faller Supervisor SO-EMDO-43	8/5/64
	1	Added Sensenich M76EMMS		
4	3	Item 5 added to Procedures Section.	H. C. Faller Supervisor SO-EMDO-43	10/20/64
5	1	Limitations Section: Revised Oil Temperature and Fuel Pressure Range	for H. C. Faller Supervisor, SO-EMDO-43	6/23/65
6	1	Limitation Section: Add note to Engine Limits	H. C. Faller Supervisor, SO-EMDO-43	1/5/66
7	2	C. G. Range: 1975 lbs. 85.9 In. 95.9 In. 1650 lbs. 84.0 In. 95.9 In. Was 18.50 lbs. 85.1 In. 95.9 In.		
	4	Added Procedures Section And Item 6		
	2	Added Placard No. 6	H. C. Faller Supervisor SO-EMDO-43	5/20/66

FAA APPROVED 8/3/62

Log of Revisions

Revision No.	Page	Description	Approved	Date
8	1	Revised Oil Temperature, Oil Pressure and Fuel Pressure Limitations		
	2,3	Revised Placards No. 3 and No. 5		
	5	Added Page 5		
		Procedures Section - Added Item 7		
	6	Added Page 6	Henry C. Faller Supervisor SO-EMDO-43	7/15/66
9	1	Limitations Section Add "or 0-360-A4A	Henry C. Faller Supervisor SO-EMDO-43	8/2/66
10	2,3	C.G. Range - Placard No. 1 and Placard No. 3 revised to include utility category operations. Added utility category max. wt. and approved maneuvers		
	4	Procedures Section - Added to Item 3 "For Normal Category Operation". Added Placard No. 7.		
	3	Placards Section - Added utility category operation to Item 4.		
	1	Added Utility Category		
	2	Added maximum positive load factor for Utility Category. Added Baggage Capacity.	Henry C. Faller Supervisor SO-EMDO-43	12/6/66

Log of Revisions

EVISION NO.	PAGE	DESCRIPTION	APPROVED	DATE
11	3	Placards Section: Revised Placard No. 1 to read, "In Full View of the Pilot"	H. C. Faller Supervisor SO-EMDO-43	5/12/67
12	2	Revised C. G. Range	H. C. Faller Supervisor SO-EMDO-43	9/25/67
13	3, 4	Revised Placard No. 4 and No. 7 to read: "In full view of the pilot"	H. C. Faller Supervisor SO-EMDO-43	4/2/68
14	1	Added Aircraft Serial Numbers 1571 and 1573 to Engine and Propeller Limitations	H. C. Faller Supervisor SO-EMDO-43	6/3/68
15	1	Added Propeller Designations	H. C. Faller Supervisor SO-EMDO-43	6/24/68
16	Title	Allocated Piper Report No. VB-163 to this Manual.	Herb M. Toomey FAA DOA SO-1	11/14/68
17	Title	Added Applicable Serial Nos. 1 Thru 4377	H. M. Toomey FAA DOA SO-1	4/22/69
	1	Added Supplement No. 1		

Log of Revisions

REVISION NO.	PAGE	DESCRIPTION	APPROVED	DATE
18	Title	Changed applicable Serial Nos. from 1 thru 4377 to 1 thru 5600.	H. M. Toomey FAA DOA SO-1	7/15/69
19	Title	Changed applicable Serial Nos. from 1 thru 5600 to 571 thru 5600.	H. M. Toomey FAA DOA SO-1	9/23/69
20	2	Added Forward Intermediate and Forward Gross Weight Points	H. M. Toomey FAA DOA SO-1	5/8/70
21	2	Deleted Forward Intermediate and Forward Gross Weight Points	G. C. Stephen FAA DOA SO-1	9/14/70
22	1	Changed oil pressure gauge markings	Ward Evans	7-25-75

Piper Model PA-28-180.
Normal and Utility Categories

AIRPLANE FLIGHT MANUAL

Limitations Section	The following limitations must be observed in the operation of this airplane.
Engine	Lycoming 0-360-A3A or 0-360-A4A
Engine Limits	Maximum permissible RPM for takeoff, 2475. For all other operations, 2700 rpm, 180 hp, (A/C S/N 28-671 to 1760A). For all operations, 2700 rpm, 180 hp, (A/C S/N 28-1571, 1573, 1761 and up).
Fuel	91/96 minimum octane aviation fuel.
Propeller	Sensenich M76 EMM or 76EM8 (S/N 671 to 1760A) Sensenich M76 EMMS or 76EM8S5 (S/N 1571, 1573, 1761 & up). Maximum diameter 76 inches, minimum diameter 76 inches. Static RPM at maximum permissible throttle setting. Not over 2450, not under 2275. No additional tolerance permitted.
Power Instruments	Oil temperature: GREEN arc (normal operating range) 120°F to 245°F; YELLOW arc (caution range) 60°F to 120°F; RED line (maximum) 245°F (S/N 671 to S/N 1760A) Oil Temperature: GREEN arc (normal operating range) 75°F to 245°F; RED line (maximum) 245°F (S/N 1571, 1573, 1761 &up). Oil Pressure: GREEN arc (normal operating range) 60 psi to 90 psi; YELLOW ARC (caution range) 25 psi to 60 psi; RED line (minimum) 25 psi when installed or 60 psi when installed; RED line (maximum) 90 psi. Fuel Pressure: GREEN arc (normal operating range) .5 psi to 5 psi; RED line (minimum) .5 psi; RED line (maximum) 5 psi (S/N 671 to S/N 1760A) Fuel Pressure: GREEN arc (normal operating range) .5 psi to 8 psi; RED line (minimum) .5 psi; RED line (maximum) 8 psi (S/N 1571, 1573, 1761 and up) Tachometer: GREEN arc (normal operating range) 500 to 2700 rpm; RED line (maximum continuous power) 2700 rpm.

Airspeed Limits

Never exceed	171 mph
Maximum structural cruise	140
Maneuvering	129
Flaps extended	115
Maximum positive load factor	3.8 Normal Category
Maximum positive load factor	4.4 Utility Category
Maximum negative load factor	No inverted maneuvers approved.

Maximum Weight

2400 lbs - Normal Category; 150 lbs - Utility Category.

Baggage Capacity

200 lbs

C. G. Range

The datum used is 78.4 inches ahead of wing leading edge at the intersection of the straight and tapered section.

1. Normal Category

Weight (Pounds)	Forward Limit (In. Aft of Datum)	Rearward Limit (In. Aft of Datum)
2400	92.1	94.5
2200	89.2	95.9
1975	85.9	95.9
1650	84.0	95.9

2. Utility Category

Weight (Pounds)	Forward Limit (In. Aft of Datum)	Rearward Limit (In. Aft of Datum)
1950	85.8	86.5
1650	84.0	86.5

Straight line variation between points given.

NOTE: It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. See weight and section for proper loading instructions.

Maneuvers

1. Normal Category - All acrobatic maneuvers including spins prohibited.
2. Utility Category - Approved maneuvers for Utility Category only.

	Entry Speed
Spins (Flaps Up)	Stall
Steep Turns	129 mph
Lazy Eights	129
Chandelles	129

lacards

1. In full view of the pilot:

"THIS AIRPLANE MUST BE OPERATED AS A NORMAL OR UTILITY CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.

ALL MARKINGS AND PLACARDS ON THIS AIRPLANE APPLY TO ITS OPERATION AS A UTILITY CATEGORY AIRPLANE. FOR NORMAL AND UTILITY CATEGORY OPERATIONS, REFER TO THE AIRPLANE FLIGHT MANUAL.

FOR SPIN RECOVERY, USE FULL RUDDER AGAINST SPIN, FOLLOWED IMMEDIATELY BY FORWARD WHEEL.

NO ACROBATIC MANEUVERS (INCLUDING SPINS) ARE APPROVED FOR NORMAL CATEGORY OPERATIONS."

2. Adjacent to upper door latch:

"ENGAGE LATCH BEFORE FLIGHT."

3. On the inside of the baggage compartment door:

"MAXIMUM BAGGAGE 125 LBS." (S/N 671 to 1760A)
(MAXIMUM BAGGAGE MAY BE INCREASED TO 200 LBS. IN ACCORDANCE WITH PIPER SERVICE SPARES LETTER NO. 242)

UTILITY CATEGORY OPERATION - NO BAGGAGE OR AFT PASSENGERS ALLOWED. NORMAL CATEGORY OPERATION - SEE AIRPLANE FLIGHT MANUAL WEIGHT AND BALANCE SECTION FOR BAGGAGE AND AFT PASSENGER LIMITATIONS.

4. In full view of the pilot:

"ROUGH AIR OR MANEUVERING SPEED 129 MPH."

"UTILITY CATEGORY OPERATION - NO AFT PASSENGERS ALLOWED."

5. On the instrument panel in full view of the pilot when the oil cooler winterization kit is installed:

"OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50° F."

6. On the instrument panel in full view of the pilot when the autoflite is installed:

"FOR HEADING CHANGES: PRESS DISENGAGE SWITCH ON CONTROL WHEEL. CHANGE HEADING, RELEASE DISENGAGE SWITCH.

lacards (Cont'd) 7. In full view of the pilot: "UTILITY CATEGORY ONLY." Acrobatic maneuvers are limited to the following:

	Entry Speed
Spins (Flaps Up).....	Stall
Steep Turns.....	129 mph
Lazy Eights.....	129
Chandelles.....	129

Airspeed Instrument Markings

RED radial line	Never exceed	171 mph (148 knots)
YELLOW arc	Caution Range (Smooth Air Only)	140 to 171 mph (121 to 148 knots)
GREEN arc	Normal Operating Range	67 to 140 mph (58 to 121 knots)
WHITE arc	Flap Down Range	57 to 115 mph (50 to 100 knots)

Procedures Section

1. The stall-warning system is inoperative with the master switch off.
2. Electric fuel pump must be on for both landing and takeoff.
3. The PA-28-180 airplane is approved under FAA Regulation CAR 3 which prohibits intentional spins for normal category operation. The following information is noteworthy:
   a. The stall characteristics of the PA-28-180 are normal with the nose pitching down moderately following the stall, occasionally with a moderate roll which can be corrected by normal use of ailerons and rudder against the roll.
   b. Prolonged use of full rudder during stall practice may result in a rapid roll followed by a spin and should be avoided. Recovery from an incipient spin may be effected in less than one additional turn by use of opposite rudder followed by full forward control wheel.
   c. In the event that a fully developed spin is inadvertently experienced, recovery is best made by using full opposite rudder followed by full forward wheel and full opposite aileron. The control positions against the spin should be maintained during the entire recovery, which may require several turns and a substantial loss of altitude if the airplane is loaded heavily with a rearward center of gravity.
4. Except as noted above, all operating procedures for this airplane are normal.

Procedures Section
(Cont'd.)

5. (Electric Pitch Trim Installation Only)
The following emergency information applies in case of electric pitch trim malfunction:

a. In case of malfunction, disengage electric pitch trim by pulling out circuit breaker on instrument panel.

b. In emergency, electric pitch trim may be overpowered using manual pitch trim.

c. In cruise configuration, malfunction results in 10^{o} pitch change and 30 Ft. altitude variation.

6. (Autoflite Installation Only)
The following emergency information applies in case of autoflite malfunction:

a. In case of malfunction PRESS disconnect switch on pilot's control wheel.

b. Rocker switch on instrument panel - OFF.

c. Unit may be overpowered manually.

d. In cruise configuration malfunction, 3 seconds delay results in 60^{o} bank, and 100 Ft. altitude loss.

e. In approach configuration malfunction, 1 second delay results in 10^{o} bank and 0 Ft. altitude loss.

7. (AutoControl III Installation Only)

I. Limitations:
Pilot off during take off and landing.

II. Procedures:

a. Normal Operation
Refers to Manufacturer's Operation Manual.

b. Emergency

1. In case of malfunction, disengage manual controls.
2. In emergency, pilot may be overpowered manually.
3. In cruise configuration malfunction, 3 seconds delay results in 60^{o} bank and 100 Ft. altitude loss.
4. In approach configuration malfunction, 1 second delay results in 10^{o} bank and 0 Ft. altitude loss.

Performance Section

The following performance figures were obtained during FAA Type tests and may be realized under conditions indicated with the airplane and engine in good condition and with average piloting technique. All performance is given for 2400 pounds.

Loss of altitude during stalls varied from 125 to 200 feet, depending on configuration and power.

Stalling speeds, in mph, power off, versus angle of bank (Calibrated Airspeed):

Angle of bank	0°	20	40	50	60
Flaps Up	67	69	76	83	94
Flaps Down	57	--	--	--	--

AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 2

CENTER OF GRAVITY RANGE

FOR

MODEL PA-28-180

THIS AIRPLANE FLIGHT MANUAL SUPPLEMENT IS APPLICABLE TO AIRCRAFT WITH SERIAL NUMBERS 28-671 TO 28-3072, INCLUSIVE, WHEN PIPER PART NO. 65280-00 TUBE-LANDING GEAR STRUT PISTON IS INSTALLED.

SERIAL NUMBERS 28-3073 TO 28-5859 MAY USE THIS SUPPLEMENT WITH NO ADDITIONAL MODIFICATION TO THE AIRCRAFT.

THIS DOCUMENT MUST BE ATTACHED TO THE AIRPLANE FLIGHT MANUAL

FAA APPROVED: Glenn C Stephen

G. C. Stephen, FAA DOA SO-1
Piper Aircraft Corporation

DATE: September 14, 1970

PIPER MODEL PA-28-180
NORMAL AND UTILITY CATEGORIES

AIRPLANE FLIGHT MANUAL SUPPLEMENT

This supplement must be attached to the Airplane Flight Manual dated August 3, 1962 or August 12, 1964 or April 22, 1969, when the expanded C. G. Envelope is used. The information contained herein supplements the information of the basic Airplane Flight Manual; for limitations, procedures, and performance data not contained in this document, consult the manual proper.

1. Limitations Section — The following limitations must be observed in the operation of this airplane with this center of gravity range:

Maximum Weight — 2400 lbs.

C. G. Range — The datum used is 78.4 inches ahead of wing leading edge at the intersection of the straight and tapered section.

1. Normal Category

Weight (Pounds)	Forward Limit (In. Aft of Datum)	Rearward Limit (In. Aft of Datum)
2400	91.0	94.5
2200	87.8	95.9
2150	87.0	95.9
1650	84.0	95.9

2. Utility Category

Weight (Pounds)	Forward Limit (In. Aft of Datum)	Rearward Limit (In. Aft of Datum)
1950	85.8	86.5
1650	84.0	86.5

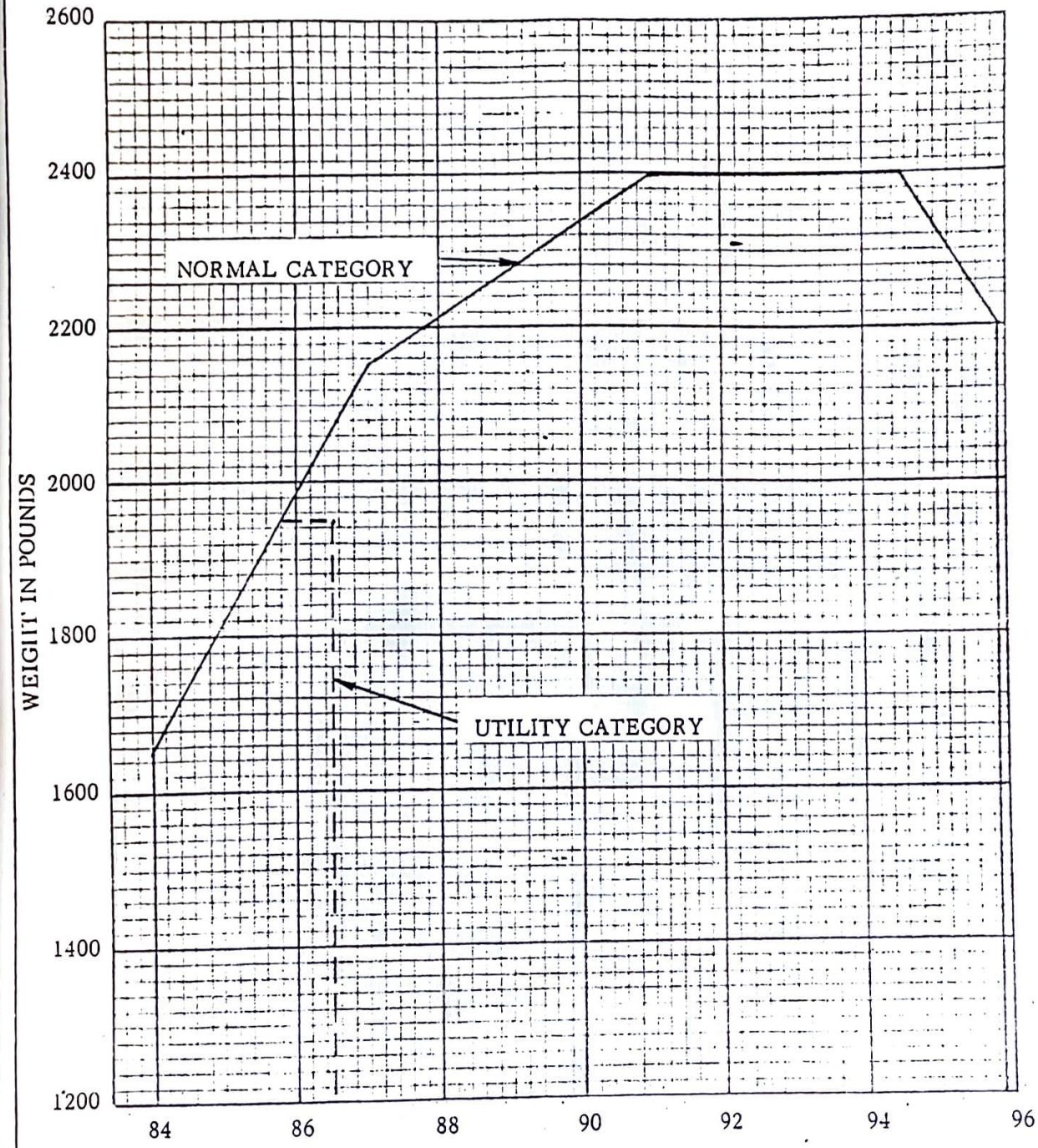
2. Procedures — "No Change"

3. Performance — "No Change"

FAA APPROVED 9/14/70

REVISED

C. G. RANGE AND WEIGHT



FAA Approved 9/14/70

REPORT VB-164

EQUIPMENT LIST

MODEL PA-28-180

SERIAL NOS. 671 THRU 4377

Log of Revisions

REVISION NO.	PAGE	DESCRIPTION	APPROVED	DATE
1	Title	Changed applicable Serial Nos. from 1 thru 4377 to 1 thru 5600.	g mc Creamer	7/15/69
2	Title	Changed applicable Serial Nos. from 1 thru 5600 to 671 thru 5600.	g. mc Creamer	9/23/69
3	Title	Changed applicable Serial Nos. from 671 thru 5600 to 671 thru 4377.	g. mc Creamer	5/8/69

Log of Revisions

SION O.:	PAGE	DESCRIPTION	APPROVED	DATE
1	Title	Changed applicable Serial Nos. from 1 thru 4377 to 1 thru 5600.	g mc Cleaver	7/15/69
2	Title	Changed applicable Serial Nos. from 1 thru 5600 to 671 thru 5600.	g. mc Cleaver	9/23/69
3	Title	Changed applicable Serial Nos. from 671 thru 5600 to 671 thru 4377.	g. mc Cleaver	5/8/69

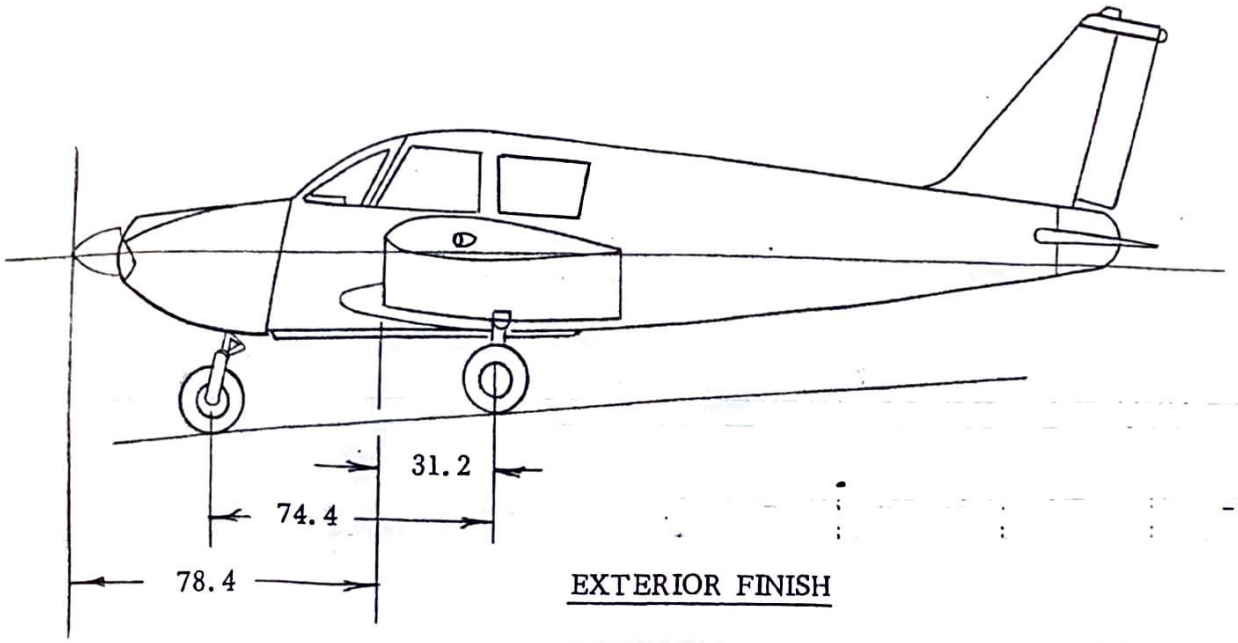
ACTUAL WEIGHT AND BALANCE

MODEL PA-28-180

SERIAL NUMBER 28 - _____

CERTIFICATE NUMBER _____

DATE _____



EXTERIOR FINISH

Base Color _____

1st Trim Color _____

2nd Trim Color _____

Registration No. Color _____

Type Finish _____

_____

WEIGHT AND BALANCE
STANDARD EQUIPMENT LIST
MODEL PA-28-180

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Engine Accessories			
_____	Engine - Lycoming Model 0-360-A3A	274.4	26.1	6962
_____	Engine - Lycoming Model 0-360-A4A	282.4	26.1	7371
_____	Fuel Pump, Electric Auxiliary, Bendix Model 478360	1.8	41.8	75
_____	Fuel Pump, Engine Driven, Lycoming Drawing Nos. 73297, 74082, 75148 or 75246	1.6	41.3	66
_____	Oil Cooler, Piper Drawing, Harrison #C-8526250	2.6	18.1	47
_____	Filter, Fram Model CA-161 PL or AC No. A48C or Purolator AFP-2	.9	20.1	18
_____	Alternator, 35-amp, Chrysler No. 2098615	12.5	19.0	238
_____	Alternator, 60-amp, Chrysler No. 2642210 or 2642997	12.5	19.0	238
_____	Starter - Lycoming 74092 (Delco-Remy 1109511)	* 18.0	19.5	351
_____	Starter - Lycoming 76211 (Prestolite MZ 4206)	* 18.0	19.5	351
	Propeller and Propeller Accessories			
_____	Propeller, Sensenich M76EMM	34.5	10.1	348
_____	Propeller, Sensenich M76EMMS60	38.5	8.8	339
_____	Spinner and Attachment Plates	2.0	8.0	16

* Included in Engine Weight.

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Landing Gear and Brakes			
_____	Two Main Wheel Assemblies 6.00-6	32.0	109.6	3507
	(a) Cleveland Aircraft Products Wheel Assembly No. 40-28 Brake Assembly No. 30-18			
	(b) Two Main 4-Ply Rating Tires 6.00-6 with Regular Tubes			
_____	Two Main Wheel Assemblies	32.3	109.6	3540
	(a) Cleveland Aircraft Products Wheel Assembly No. 40-86 Brake Assembly No. 30-55			
	(b) Two Main 4-Ply Rating Tires 6.00-6 with Regular Tubes			
_____	One Nose Wheel 6.00-6	14.0	34.3	480
	(a) Cleveland Aircraft Products Wheel Assembly No. 38501 (Less Brake Drum)			
	(b) One Nose Wheel 4-Ply Rating Tire 6.00-6 with Regular Tubes			
	Electrical Equipment			
_____	Stall Warning Device, Safe Flight Instrument Corporation No. C52207-4	.2	80.2	16
_____	Voltage Regulator, Delco-Remy #118704	1.5	168.5	253
_____	Voltage Regulator, Chrysler #2098613	.5	57.8	29
_____	Voltage Regulator, Wico Electric #X-16300	.5	57.8	29
_____	Battery 12V, 25 A.H., Rebat Model S-25	21.5	160.9	3540

Check if Installed	ITEM	WEIGHT (LBS.)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Instrument			
_____	Compass - Airpath No. C2350-L41	.9	66.6	60
_____	Airspeed Indicator, PAC 63205-2	.6	67.7	41
_____	Tachometer, AC 1548302	.8	67.7	54
_____	Tachometer, Stewart Warner PAC 62177-2 or 62177-3	.7	67.7	47
_____	Altimeter, Aero Marine No. 522	1.4	66.8	94
_____	Engine Cluster, PAC 63922-2	.8	68.8	55
_____	Engine Cluster, PAC 63426	.8	68.8	55
_____	Engine Cluster, PAC 63426-2	.8	68.8	55
	Miscellaneous			
_____	Fwd. Seat Belts	1.0	86.9	87
_____	Aft Seat Belts	.8	123.0	98
_____	Flight Manual	----	----	----
_____	Tow Bar	1.3	122.3	139
	TOTAL			
	AIRCRAFT EMPTY WEIGHT AS (INCLUDES ITEMS CHECKED ON STANDARD EQUIPMENT LIST, UNUSABLE FUEL AND UNDRAINABLE OIL)	_____	_____	_____

OPTIONAL EQUIPMENT LIST
MODEL PA-28-180

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Engine Accessories			
_____	Vacuum Pump, Airborne Mechanisms Model No. 10-113A1, 113A5 or 200 cc and Drive	5.0	37.0	185
_____	Oil Filter - Lycoming #74911 (AC 81-A #6437032)	3.3	40.5	134
_____	Vacuum Regulator and Filter	2.2	57.0	125
	Electrical Equipment			
_____	Rotating Beacon, Grimes Model D7080	2.0	263.4	527
_____	Landing Light, G. E. Model 4509	.5	18.1	9
_____	Navigation Light (Rear) (1) Grimes Model 2064 (White)	.2	281.0	56
_____	Navigation Lights (2) Grimes Model A1285 (Red and Green)	.4	106.6	43
_____	Battery 12V, 35 A.H., Reading R-35	27.0	160.9	4344
_____	Cabin Light	.3	104.0	31
_____	Cabin Speaker	.8	104.0	83
_____	Rotating Beacon, Whelen Model WRM L-12	1.6	264.0	422

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Electrical Equipment (Cont'd)			
_____	Auxiliary Power Receptacle PAC 62225	2.7	168.0	454
_____	External Power Cable PAC 62355-2	4.6	142.8	657
_____	Piper Pitch Trim	4.0	158.0	632
_____	Heated Pitot Head	.4	100.0	40
	Instruments			
_____	Turn and Bank, Pioneer A-5	1.5	66.4	100
_____	Turn and Bank, Electric	2.7	65.8	178
_____	Suction Gauge, AN5771-11	.5	68.1	34
_____	Suction Gauge, Airborne Mechanisms 1G3-4	.5	68.1	34
_____	Suction Gauge, U.S. Gauge AW1821AFO3	.5	68.1	34
_____	Altimeter, AN5760-2 (C-12 or C-13)	Same as Standard Equipment Weight		
_____	Rate of Climb, Pioneer C-7	1.0	66.8	67
_____	Rate of Climb, AN5825	1.0	66.8	67
_____	Directional Gyro, Jack & Heintz	2.6	66.6	173
_____	Directional Gyro, Sperry	3.9	66.6	260
_____	Directional Gyro, Garwin (3")	2.4	65.6	157
_____	Directional Gyro, AIM (3")	3.1	64.9	201

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Instruments (Cont'd)			
_____	Artificial Horizon, Jack & Heintz	2.8	66.1	185
_____	Artificial Horizon, Garwin (3")	1.8	65.8	118
_____	Artificial Horizon, AIM (3")	2.2	65.3	144
_____	Air Temperature Gauge, Rochester Manufacturing Co., No. 1592-C2 or NHM-70 (Manning, Maxwell & Moore)	.2	82.6	17
_____	Clock, 8-Day, MIL-C-7939	.4	68.3	27
_____	Tru-Speed Indicator, PAC 62143-2	Same as Standard Equipment Weight		
_____	Piper Course Selector PAC 31058	3.0	66.6	200
_____	Electric Turn and Bank	2.7	65.8	178
_____	Pictorial Rate of Turn, Mitchell 52D69	1.3	66.2	86
_____	Rate of Climb, Karnish AC135-3	1.0	66.8	67
_____	Brittain Turn Coordinator #TC-100(12)	2.6	65.6	171
	AutoPilots			
_____	AutoControl II			
_____	Roll Servo, Mitchell #1X221E-CH-1	2.8	60.6	170
_____	Console, Mitchell #1X224E-3	1.3	66.6	87
_____	Directional Gyro, Mitchell #52B15E	4.3	66.6	286
_____	or Directional Gyro, Course Selector PAC Drawing 31058-2	3.0	66.6	200

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	AutoPilots (Cont'd)			
	Artificial Horizon, Mitchell #52B9	4.5	66.1	298
	AutoControl III			
	Roll Servo, Mitchell #1D363-183R	2.5	122.2	306
	Console, Mitchell #1C338	1.2	66.6	80
	Cables	.7	95.5	67
	Attitude Gyro, Mitchell #52D66 (Garwin)	1.9	65.8	125
	Attitude Gyro, Mitchell #52D66 (AIM)	2.3	65.3	150
	Directional Gyro, Mitchell #52D54P (Garwin)	2.5	65.6	164
	Directional Gyro, Mitchell #52D54P (AIM)	3.2	64.9	208
	Omni Coupler	.9	65.8	59
	AutoFlite			
	Roll Servo, Mitchell #1D363-153	2.6	122.2	318
	Gyro Amplifier, Mitchell #1C359	1.8	111.8	201
	Cables	1.0	95.5	96
	Panel Unit	.3	68.8	21
	Omni Tracker (#1D482)	.5	64.5	32

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Radio			
	PM-1 Marker Beacon			
	Receiver	1.1	121.3	133
	Panel Unit	.3	69.0	21
	Cable	.3	85.0	26
	Piper Radio Compass PRC-3	4.5	64.4	290
	Piper VHF Transceiver PTR-1	5.0	64.8	324
	Piper Omni Convertor O-1	2.5	65.3	163
	King KX150B	9.1	62.8	572
	Omni Receiving Antenna, Narco VTP-37 (Includes Cables)	1.4	203.0	284
	VHF Antenna, Transmitting VHF-1	.3	157.8	47
	VHF Antenna, Transmitting VHF-2	.3	192.8	58
	Cable, VHF-1	.4	118.0	47
	Cable, VHF-2	.5	135.0	68
	Low Frequency Antenna	.5	167.0	84
	Loop Antenna (PRC-3)	.3	54.5	16
	Narco Mark 12A			
	Transceiver, Single	6.0	62.8	377
	Transceiver, Dual	12.0	62.8	754
	Modulator-Power Unit, Single	4.0	56.0	224
	Modulator-Power Unit, Dual	8.0	186.0	1488

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Radio (Cont'd)			
_____	Cable, Single	.3	58.0	17
_____	Cable, Dual	3.4	120.0	408
_____	Narco VOA-6 Omni Convertor	1.8	65.3	118
_____	Narco VOA-5 Omni Convertor	3.1	65.3	202
_____	Narco VOA-4 Omni Convertor	3.0	65.3	196
_____	Narco ADF-30	9.9	107.9	1068
_____	Narco Omnigator VTR-2A Installation (Less Antenna)	14.0	58.0	812
_____	Marker Antenna	1.2	64.8	78
_____	Piper Radio Compass PRC-4	4.9	64.4	316
_____	Loop Antenna (PRC-4)	.4	112.6	45
_____	Piper Omni Convertor OL-1	2.8	65.3	183
_____	Narco ADF-31			
_____	Receiver	5.1	64.4	328
_____	Loop Antenna	2.7	162.0	437
_____	Cable Antenna	1.7	108.0	184
_____	Bendix ADF-T-12C			
_____	Receiver	3.8	64.9	247
_____	Audio Amplifier	.8	64.9	52
_____	Radio Compass	1.7	67.3	114

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Radio (Cont'd)			
	Loop Antenna	1.2	160.8	193
	Cable, Antenna	1.5	108.0	162
	Narco - UDI-III DME	8.6	62.6	538
	Narco Mark III	7.5	63.6	477
	Narco UDI-4 DME			
	Receiver	8.5	62.6	532
	Antenna	.3	113.9	34
	Cable, Antenna	.4	100.0	40
	UGR-2 Glide Slope			
	Receiver	2.4	173.8	417
	Cable	2.1	128.0	269
	Antenna	.4	92.4	37
	Cable, Antenna	.5	145.0	73
	Transmitter Selector (Dual VHF Only)	.7	67.2	47
	Microphone	.5	75.0	38
	Headset	.5	66.0	33
	Junction Box	.6	67.2	40

Check if Installed	ITEM	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
	Miscellaneous			
_____	Nose Wheel Fairing	3.5	34.8	122
_____	Main Wheel Fairing	7.4	109.6	811
_____	Assist Step	1.8	156.0	281
_____	Toe Brakes (Dual)	10.5	54.6	573
_____	Toe Brakes (Single)	5.0	54.6	273
_____	Fire Extinguisher-Stop Fire #A-20	7.5	93.0	698
_____	Inertia Safety Belt PAC 65766	2.5	111.6	279
_____	Assist Strap and Coat Hooks	.2	109.5	22
_____	Lighter	.2	68.8	14
_____	Fire Extinguisher, Kidde Kompact VI (With Brackets)	5.3	85.0	451
	TOTAL			

EMPTY C.G. AFT DATUM IS _____

AIRCRAFT EMPTY WEIGHT _____ _____

OPTIONAL EQUIPMENT WEIGHT _____ _____

LICENSED EMPTY WEIGHT _____ _____

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY. THE EMPTY WEIGHT C.G. IS FOR THE AIRPLANE AS DELIVERED FROM THE FACTORY. REFER TO FORM FAA-337 WHEN ALTERATIONS HAVE BEEN MADE.

C.G. RANGE AND WEIGHT INSTRUCTIONS

1. Add the weight of all items to be loaded to the licensed empty weight.
2. Use the loading graph to determine the moment of all items to be carried in the airplane.
3. Add the moment of all items to be loaded to the licensed empty weight moment.
4. Divide the total weight moment by the total weight to determine the C.G. location.
5. By using the figures of item 1 and item 4, locate a point on the C.G. range and weight graph. If the point falls within the C.G. envelope, the loading meets all weight and balance requirements.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)

	WEIGHT (LBS)	ARM AFT DATUM (INCHES)	MOMENT (POUND-INCHES)
LICENSED EMPTY WEIGHT			
OIL (2 GALLON)	15	32.5	488
PILOT & PASSENGER	340	85.5	29070
FUEL		95.0	
PASSENGERS (REAR SEAT) *	340	118.1	40154
BAGGAGE *	_____	142.8	_____
TOTAL LOADED AIRPLANE			

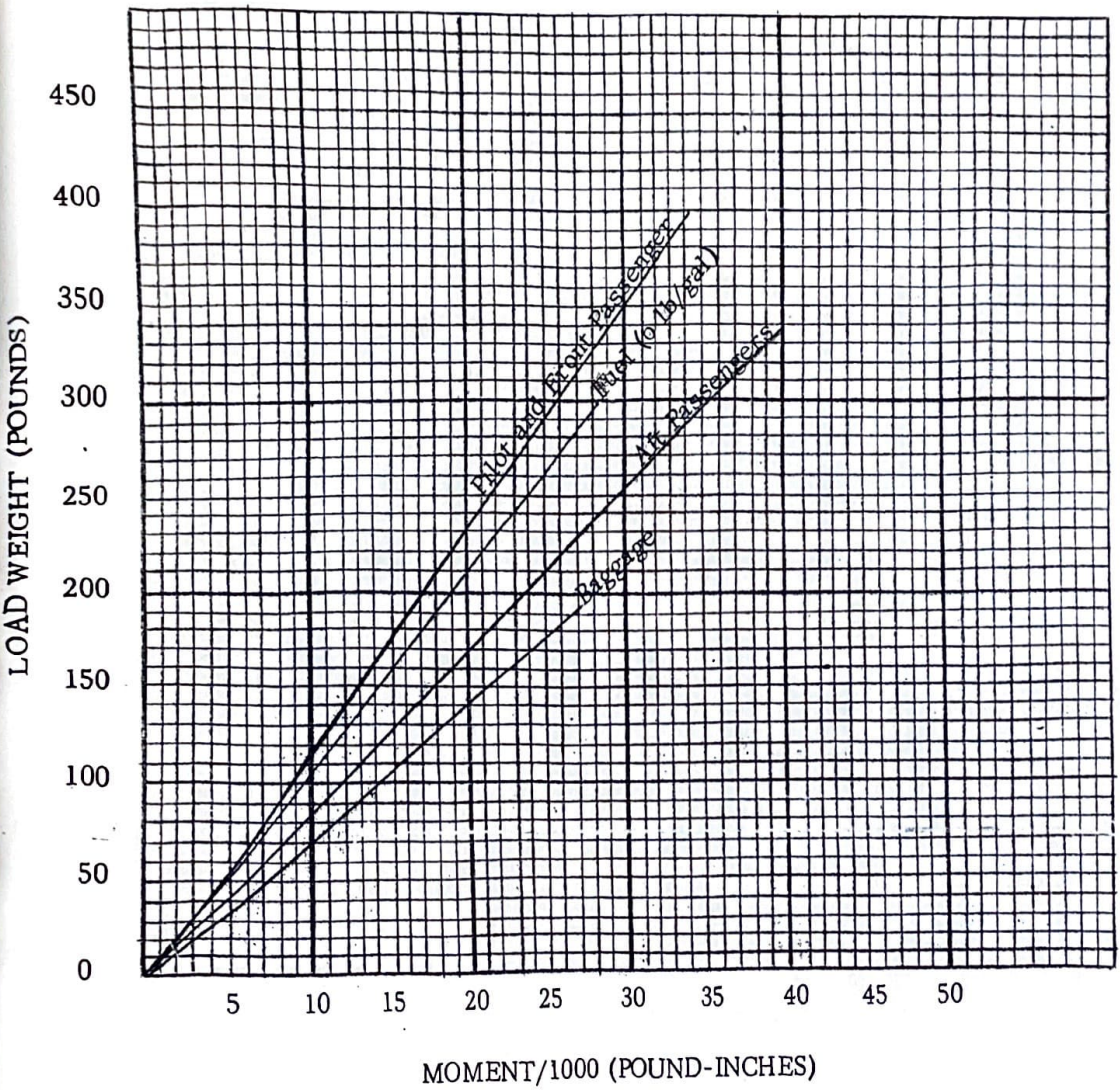
_____ = INCHES (ARM AFT DATUM)

LOCATE THIS POINT ( ) ON THE C.G. RANGE AND WEIGHT GRAPH. SINCE THIS POINT FALLS WITHIN THE C.G. ENVELOPE THE LOADING MEETS ALL WEIGHT AND BALANCE REQUIREMENTS.

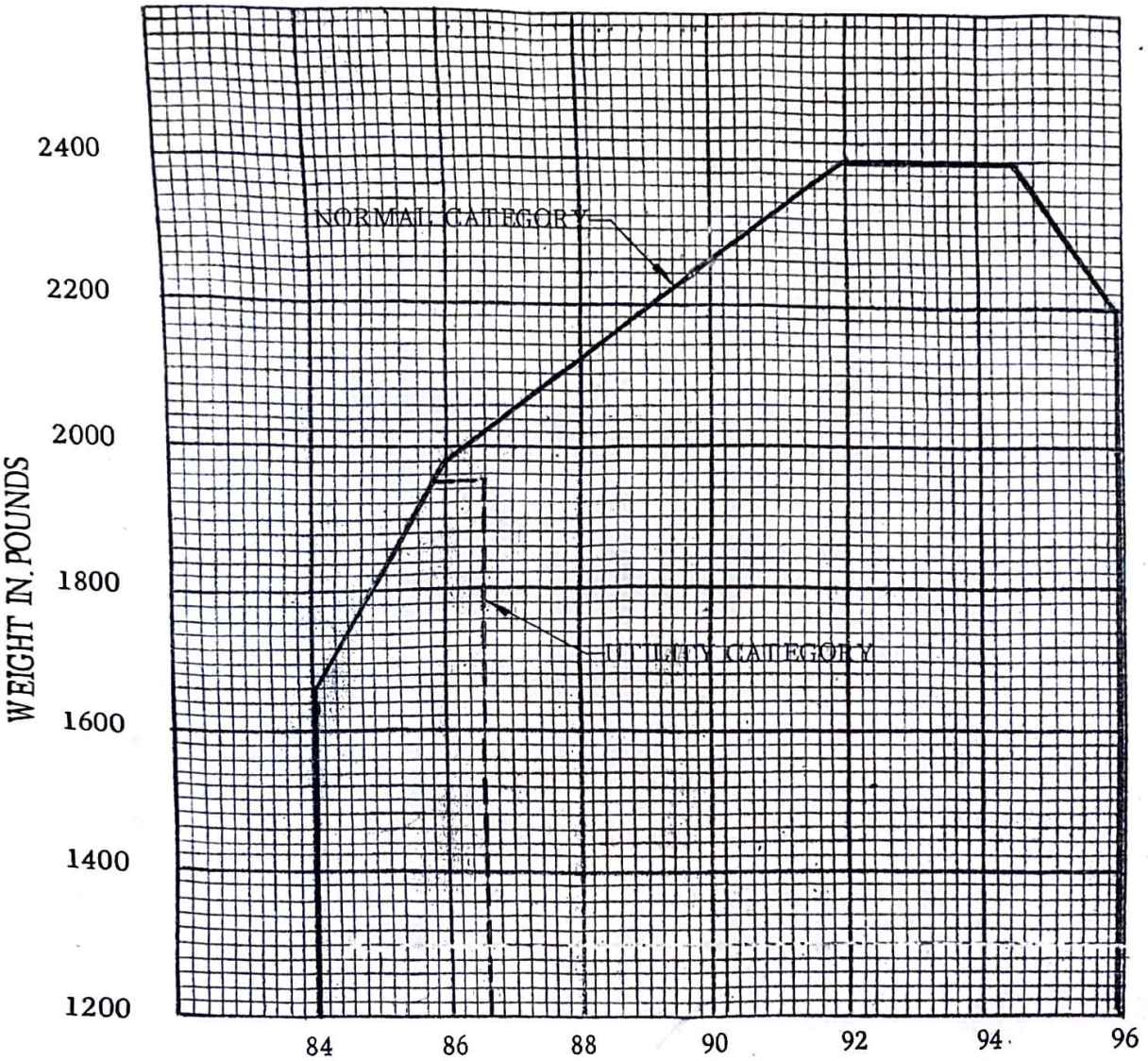
* Utility Category Operation - No baggage or aft passengers allowed.

Normal Category Operation - Maximum baggage 125 lbs. (S/N 671 to 1760A).
Maximum baggage 200 lbs. (S/N 1761 and up).
Check aft C.G. between 150 lbs. and 200 lbs.

LOADING GRAPH



C. G. RANGE AND WEIGHT



SWAMP FOX AVIONICS, LLC
YOUR AVIONICS SPECIALIST
373 Aviation Way - Walterboro, SC 29488
FAA CRS #8FXR273D

AIRCRAFT WEIGHT AND BALANCE COMPUTATION

AND EQUIPMENT LIST AMMENDMENT

Date: 14-Mar-2019
craft Registration: N4923L
Aircraft S/N: 28-4289

Work Order#: SFA19-019
Aircraft Make: Piper
Aircraft Model: PA-28-180

	WEIGHT	ARM	MOMENT
PREVIOUS DATA DATED: 26-Nov-2018	**1323.59**	**84.44**	**111764.95**
MS REMOVED			
tio Instrument MFG Corp ADI P/N 700-4CF	2.70	66.05	178.34
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	-2.70	-66.05	-178.34
MS INSTALLED			
min G5 Attitude Indicator P/N 011-03809-00	0.98	68.30	66.93
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	0.98	68.30	66.93
TOTAL:	**-1.72**	**2.25**	**-111.40**

MAX GROSS WEIGHT: **2400.00**
NEW EMPTY CG: **84.47**
NEW MOMENT: **111653.55**

NEW EMPTY WEIGHT: **1321.87**
USEFUL LOAD: **1078.13**

Signed
Douglas E Rupp DRS01 for CRS 8FXR273D

SWAMP FOX AVIONICS, LLC

373 Aviation Way - Walterboro, SC 29488

FAA CRS #8FXR273D

AIRCRAFT WEIGHT AND BALANCE COMPUTATION

AND EQUIPMENT LIST AMMENDMENT

Date: 26-Nov-2018 **Work Order#:** SFA18-143

Aircraft Registration: N4923L **Aircraft Make:** Piper

Aircraft S/N: 28-4928 **Aircraft Model:** PA-28-180

	WEIGHT	ARM	MOMENT
PREVIOUS DATA DATED: 7-Nov-2018	**1323.06**	**84.45**	**111731.40**
ITEMS REMOVED			
Narco AT 150 TSO transponder and tray	2.77	63.30	175.34
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	-2.77	-63.30	-175.34
ITEMS INSTALLED			
Appareo Stratus ES transponder P/N 153510-000069	3.30	63.30	208.89
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	3.30	63.30	208.89
TOTAL:	**0.53**	**0.00**	**33.55**

SUPERCEDED 14 MAR 19

MAX GROSS WEIGHT:	**2400.00**	NEW EMPTY WEIGHT:	**1323.59**
NEW EMPTY CG:	**84.44**	USEFUL LOAD:	**1076.41**
NEW MOMENT:	**111764.95**		

Signed

Douglas E Rupp DRS01 for CRS 8FXR273D

SWAMP FOX AVIONICS, LLC
373 Aviation Way - Walterboro, SC 29488
FAA CRS #8FXR273D

AIRCRAFT WEIGHT AND BALANCE COMPUTATION

AND EQUIPMENT LIST AMMENDMENT

Date: 7-Nov-2018
Aircraft Registration: N4923L
Aircraft S/N: 28-4928

Work Order#: SFA18-138
Aircraft Make: Piper
Aircraft Model: PA-28-180

	WEIGHT	ARM	MOMENT
PREVIOUS DATA DATED: 15-Oct-2018	**1323.6**	**84.44**	**111767.73**
ITEMS REMOVED			
arco CP 136 Audio Panel	1.53	66.90	102.36
S Engineering PM 1000 ICS	0.51	67.30	34.32
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	-2.04	-134.20	-136.68
ITEMS INSTALLED			
S Engineering PMA 6000B Audio Panel	1.50	66.90	100.35
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
SUBTOTAL:	1.50	66.90	100.35
TOTAL:	**-0.54**	**-67.30**	**-36.33**

SUPERCEDED 26 NOV 18

MAX GROSS WEIGHT: **2400.00**
NEW EMPTY CG: **84.45**
NEW MOMENT: **111731.40**

NEW EMPTY WEIGHT: **1323.06**
USEFUL LOAD: **1076.94**

Signed
Douglas E Rupp DRS01 for CRS 8FXR273D

WEIGHT & BALANCE AND EQUIPMENT LIST UPDATE

A/C MAKE: Piper | MODEL: PA28-180 | SERIAL NO: 28-4289 | REG NO: N4923L

GROSS WEIGHT: 2400.00 | OLD EMPTY WT: 1329.2 | OLD USABLE: 1070.8

OLD MOMENT: 112115.56 | OLD CG: 84.35 | DATE: unk

INSTALLED

MANUFACTURER/MODEL	DESCRIPTION	PART NUMBER	SERIAL NUMBER	WEIGHT	ARM	MOMENT
Garmin GNS 430W and tray	GPS/Nav/Com	011-01060-00	97117346	6.2	63.90	396.18
Garmin GA 35	GPS WAAS antenna	013-00235-00	146215	0.5	139.83	69.92
Garmin GI 106B	Course deviation Ind.	MD200-606	J18-12321	1.3	66.90	86.97
			SUBTOTAL INSTALLED	8.0	270.63	553.07

REMOVED

MANUFACTURER/MODEL	DESCRIPTION	PART NUMBER	SERIAL NUMBER	WEIGHT	ARM	MOMENT
Narco Nav 824 TSO	Radio Nav	NAV 824	11232	3.0	63.90	191.70
Narco ID 824 TSO	Course deviation Ind.	ID 824	10138	0.9	66.90	60.21
Narco ADF 141 TSO	ADF	ADF 141	52350	3.0	65.00	195.00
Narco COM 810 TSO	VHF Com	COM 810	11504	3.6	63.90	230.04
Garmin GPS 155XL	GPS Nav	011-00412-00	950002151	2.8	65.00	182.00
Garmin GA 56	GPS antenna	011-00134-00	59029754	0.3	139.83	41.95
			SUBTOTAL REMOVED	13.6	464.53	900.90
			NET TOTAL	-5.6		-347.83

SUPERCEDED 07 NOV 18

GROSS WEIGHT: 2400.00 | NEW EMPTY WT: 1323.6 | NEW USABLE: 1076.4

NEW MOMENT: 111767.73 | NEW CG: 84.44 | DATE: 15 October 2018

Prepared by Douglas Rupp DRS01, Swamp Fox Avionics, LLC, (907) 306-1301

Douglas E Rupp DRS01 15 OCT 18

LOG OF REVISIONS

Rev. No.	Page No.	Date	Description	FAA Approved
A Original	All	11-20-07	Complete Supplement	Seyed-Youssef Hashemi Mgr. Flt. Test Br., ANM-160L FAA, Los Angeles ACO Transport Airplane Directorate Date: Nov. 20, 2007
B	All	07/31/09	Added '-D' to STC number, added LP approach type	David G Armstrong ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
C	All	03/21/13	Complete Rewrite	Michael Warren ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
D	10, 14	01/27/14	Added LP +V approach type	Michael Warren ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
E	8,9 11 13,14 21 22	11/20/2014	Updated document revisions and added Flight Stream 210 Added note for Flight Stream 210 Added sections 2.14 and 2.15 Updated GTN Crossfill section Added Section 7.3	Michael Warren ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
F	12 13	11/22/2017	Revised section 2.12 GTN Crossfill Corrected 91.23 to 91.21	See Page 1

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E	8,9 11 13,14 21 22	11/20/2014	Updated document revisions and added Flight Stream 210 Added note for Flight Stream 210 Added sections 2.14 and 2.15 Updated GTN Crossfill section Added Section 7.3	Michael Warren ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
F	12 13	11/22/2017	Revised section 2.12 GTN Crossfill Corrected 91.23 to 91.21	See Page 1

Table of Contents

Section 2. LIMITATIONS

2.1 Pilot's Guide

The Quick Reference Guide, part number and revision listed below (or later applicable revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the 4XXW Series unit.

- 400W Series Quick Reference Guide P/N 190-00356-01 Rev J

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 4XXW Series unit:

GDL 69/69A XM Satellite Data link
GDL 88 ADS-B Transceiver
GTX 330/330D TIS
GTS 8XX Series TAS
Flight Stream 210

- 400W/500W Series Optional Displays P/N 190-00356-30 Rev L

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 4XXW Series unit:

Stormscope® Lightning Detection System
Skywatch® Traffic Advisory System
Bendix/King® Traffic Advisory System
Avidyne/Ryan TCAD Traffic System

- 400W/500W Series Display Interfaces P/N 190-00356-31 Rev D

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval. Systems limited to VFR shall be placarded in close proximity to the 4XXW Series unit: **"GPS LIMITED TO VFR USE ONLY"**.

2.3 System Software

This AFMS/AFM is applicable to the software versions shown in Table 1.

The Main and GPS software versions are displayed on the start-up page immediately after power-on.

Software Item	Approved Software Version *(or later FAA approved versions for this STC)*	
	SW version	As displayed on unit
Main SW Version	5.40	5.40
GPS SW Version	5.0	5.0
Flight Stream 210	2.80	2.80 (Displayed on GNS)

Table 1 – Required Equipment

2.4 Navigation database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.5 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 software version 3.00 or later approved version with Garmin approved antennas or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), and Standard Terminal Arrival (STAR), routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

NOTE

If flight plan information is imported from a portable electronic device utilizing the Flight Stream 210, all waypoints and flight plan information must be verified by the crew.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.6 Approaches

- Instrument approaches using GPS guidance may only be conducted when the GNS is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, LP, or LP +V)

NOTE

Advisory vertical guidance deviation is provided when the GNS annunciates LNAV+V or LP +V. The controlling minimums remain LNAV or LP even when advisory vertical guidance is provided. Advisory vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions in

accordance with the LNAV or LP approach procedure.

- When conducting instrument approaches referenced to true North, the NAV Angle on the AUX-Units/Position page must be set to **True**.
- The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
- Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GNS system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.
- IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GNS and/or the CDI.

2.7 Autopilot Coupling

IFR installations of a Garmin 4XXW Series unit allow the operator to fly all phases of flight based on the navigation information presented to the pilot; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes; however, the FAA requires that vertical coupling of an autopilot for approaches be demonstrated to meet their intended function and provide safe and proper operation to published minimums. This installation is limited to:

- ☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.8 Terrain Proximity Function

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No change.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GNS will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GNS by an amber "DR" or "INTEG".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation..... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation..... **USE GNS**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation .....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "No GPS Position" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LNAV/VNAV, LP +V, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver prior to the Final Approach Fix, the GNS will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, LP +V, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums. After the Final Approach Fix has been passed, the approach will be aborted using the indications described below.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GNS will flag all CDI guidance and display a system message "ABORT APPROACH - Loss of Navigation". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications ..... **USE ALTERNATE COM**

If no alternate COM is available:

COM RMT XFR key (if installed).....**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GNS. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

Section 4. NORMAL PROCEDURES

Refer to the 4XXW Series unit Quick Reference Guide defined in paragraph 2.1 on page 7 of this document for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information. For information on TIS traffic or data linked weather, see the Pilot's Guide addendum for optional displays. For information on active traffic device or Stormscope operation and displays see the Pilot's Guide addendum for display interfaces.

The 4XXW Series unit requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Database ..... **REVIEW EFFECTIVE DATES**
Self Test ..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self Test - GPS Remote Annunciator (If Installed):
- VLOC ..... **ILLUMINATED**
- GPS ..... **ILLUMINATED**
- INTG ..... **ILLUMINATED**
- TERM ..... **ILLUMINATED**
- WPT ..... **ILLUMINATED**
- APR ..... **ILLUMINATED**
- MSG ..... **ILLUMINATED**
- SUSP ..... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators ..... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GNS the pilot should rotate the course pointer as prompted on the GNS.

If an EHSI is used to display navigation data from the GNS the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.4 Autopilot Operation

The GNS may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GNS system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GNS, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GNS. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will issue a flashing message indication with the following message "APR Guidance Available, Use PROC before A/P APR".

PROC Button ..... **PRESS**
"Enable A/P APR Outputs?" ..... **SELECT**
ENT Button ..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot ..... **ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will enable vertical guidance.

Vertical Guidance ..... **CONFIRM AVAILABLE**
Autopilot ..... **ENGAGE APPROACH MODE**

☐ The autopilot does not support any vertical capture or tracking in this installation.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

4.6 Traffic Mode Selection (Optional)

If the GNS is interfaced to a traffic device, the GNS can be used to control the mode of the traffic system. This is accomplished by pressing the cursor knob while on the dedicated traffic page to enter/exit the traffic device menu. It is important to note that while the traffic device menu is active, the current state of the traffic system is *not* displayed. The state of the traffic device is only displayed once the traffic device menu is exited.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

See Garmin 4XXW Series unit Pilot's Guide for a complete description of the 4XXW Series unit.

7.2 Manual GTN Crossfill

Manual GTN Crossfill is a feature that will keep the GNS system in sync with a flight plan that is being used on the GTN system. The GTN *will not* automatically keep its flight plan in sync with changes made on the GNS system. Manual crossfill feature is "one way" – from the GTN to the GNS.

The GTN systems support a variety of procedure leg types that the GNS systems do not support. As such, it is normal and expected that the flight plan leg that is displayed on the GNS system will not always match the flight plan leg on the GTN system. Departure, arrival and approach procedures contain leg types that the GNS does not support. The GNS typically "skips" over these leg types and provides no guidance. Guidance may be available on the GTN but not on the GNS in these cases. The GNS will sequence the procedure as it normally would if Crossfill were not active. Once a leg type is reached that is supported on both the GTN and GNS systems, the systems will automatically sync to the same leg.

If the GNS is interfaced with a GTN and the GTN Crossfill feature is enabled on the GNS, then auto-switching from GPS to VLOC guidance on the CDI for ILS/LOC approaches will be disabled on the GNS..

If the flight plan on an interfaced GTN is altered while in a hold, the GNS will reinitiate guidance to the holding waypoint and sequence into the hold upon crossing the waypoint.

If the Missed Approach is activated on the GTN prior to reaching the Missed Approach Point, the GTN will automatically resume leg sequencing upon reaching the Missed Approach Point. The GNS will remain suspended upon reaching the Missed Approach Point and leg sequencing must be manually resumed.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

See Garmin 4XXW Series unit Pilot's Guide for a complete description of the 4XXW Series unit.

7.2 Manual GTN Crossfill

Manual GTN Crossfill is a feature that will keep the GNS system in sync with a flight plan that is being used on the GTN system. The GTN *will not* automatically keep its flight plan in sync with changes made on the GNS system. Manual crossfill feature is "one way" – from the GTN to the GNS.

The GTN systems support a variety of procedure leg types that the GNS systems do not support. As such, it is normal and expected that the flight plan leg that is displayed on the GNS system will not always match the flight plan leg on the GTN system. Departure, arrival and approach procedures contain leg types that the GNS does not support. The GNS typically "skips" over these leg types and provides no guidance. Guidance may be available on the GTN but not on the GNS in these cases. The GNS will sequence the procedure as it normally would if Crossfill were not active. Once a leg type is reached that is supported on both the GTN and GNS systems, the systems will automatically sync to the same leg.

If the GNS is interfaced with a GTN and the GTN Crossfill feature is enabled on the GNS, then auto-switching from GPS to VLOC guidance on the CDI for ILS/LOC approaches will be disabled on the GNS..

If the flight plan on an interfaced GTN is altered while in a hold, the GNS will reinitiate guidance to the holding waypoint and sequence into the hold upon crossing the waypoint.

If the Missed Approach is activated on the GTN prior to reaching the Missed Approach Point, the GTN will automatically resume leg sequencing upon reaching the Missed Approach Point. The GNS will remain suspended upon reaching the Missed Approach Point and leg sequencing must be manually resumed.

7.3 Flight Stream 210

The Flight Stream 210 provides wireless communication of specific flight plan information and GPS sensor data to a PED (Personal Electronic Device) from the GNS.

For details on the operation and features of the Flight Stream 210, please refer to the GNS 400W/500W Series Optional Displays, P/N 190-00356-30 Rev J.

For additional details about the Garmin supported devices and apps for use with the Flight Stream 210, please visit:
http://garmin.com/connext/supported_devices

APPAREO
1810 NDSU Research Circle N
Fargo, ND 58102
Doc No: 606586-000075, Rev. 2.0

FAA-APPROVED

Airplane Flight Manual Supplement

Appareo Stratus ES/ESG

ADS-B Out Transponder

Aircraft Make and Model: Piper PA-28-140

Registration Number: N4923L

Serial Number: 28-4289

This supplement must be attached to the FAA-Approved Airplane Flight Manual when Stratus ES/ESG is installed in accordance with STC SA04112CH.

The information contained in this document supplements or supersedes the basic manual only in those areas listed. For limitations, procedures, performance, and loading information not contained in this supplement, consult the basic Airplane Flight Manual.

FAA-Approved _____
Manager, Southwest Flight Test Section, AIR 713
Federal Aviation Administration
Ft. Worth, Tx

Date: _____

FAA APPROVED
Date: SEP 20 2017

Log of Revisions

Revision Number	Pages Affected	Change Description	FAA Approved	Date
1.0	All	Initial Release		
1.1	All	CM 10298		
1.2	All	CM 10631		
1.3	All	CM 10938		
1.4	All	CM 11058		
1.5	All	CM 11113		
1.6	All	CM 11317	Steve Lardinois	7/7/16
1.7	All	CM 13060	Steve Lardinois	4/12/17
2.0	All	Added Stratus ES	Manager, Southwest Flight Test Section, AIR 713 Federal Aviation Administration Ft. Worth, Tx	9/20/2017

Related Documentation

Information specific to the normal operation of Stratus ES/ESG can be found in the Stratus ES/ESG Pilot's Guide (Appareo document number 600890-000049). Additional information about the operation and maintenance of Stratus ES/ESG can be found in the documents below.

Document Number	Title
600840-000032	Stratus ES/ESG Installation Instructions
600845-000025	Stratus ES/ESG Instructions for Continued Airworthiness
601837-000024	Stratus ES/ESG Installation Drawings and Wiring Diagrams

To view the most current version of this document, go to appareo.com/dealer-portal or www.appareo.com/resources.

Chapter 1. General

Stratus ES/ESG by Appareo is an ADS-B Out transponder designed to help pilots meet the FAA 2020 mandate. Stratus ES/ESG responds to legacy Mode A/C interrogations and Mode S interrogations from both ground radar and airborne collision avoidance systems. Stratus ES/ESG are 1090 ES transponders, where Stratus ES connects to an external GPS and Stratus ESG has a certified WAAS GPS in the same box.

Chapter 2. Operating Limitations

- Stratus ES/ESG meets 14 CFR 91.227 ADS-B Out equipment performance requirements. Ensure that the system is functioning properly, including verifying the following items:
  - Stratus ES/ESG transponder display is functional.
  - GPS integrity is assured. The ⌖ icon will display if GPS integrity is assured.
  - No built-in-tests (BITs) were detected by the system. If a BIT failure is detected, the ⚠ icon will display along with an error message describing the BIT code.
- The Stratus ES/ESG Pilot's Guide (600890-000049) must be immediately available to crew members whenever Stratus ES/ESG is in operation.
- Stratus ES/ESG must operate with current software. Software listed below is current as of the time of publication of this document.

Software	Part number	Revision (or later FAA approved)
Embedded Hardware (FPGA)	501010-000109	R04
Software (DSC)	501010-000113	R06

Chapter 3. Emergency Procedures

No change.

Chapter 4. Normal Procedures

- When directed by ATC to suppress pressure altitude reporting, use Stratus ES/ESG's **ON** key.

See the Stratus ES/ESG Pilot's Guide (Appareo document number 600890-000049) for a full description of Stratus ES/ESG's function.

Chapter 5. Abnormal Operating Procedures

- The location of the circuit breaker will generally be located on the avionics circuit breaker panel. Location of the breaker may vary with each aircraft. The breaker has a rating of 5 amps and is labeled "XPNDR."
- **If the circuit breaker opens, it may be reset only once.**
- Use the table below to troubleshoot possible problems with Stratus ES/ESG.

Problem	Troubleshooting Steps
GPS information is not being received	Verify that the aircraft has a clear view of the sky. **NOTE:** Initial GPS fix could take up to 20 minutes.
The power key does not power on Stratus ES/ESG	1. Verify that the power key is not stuck. 2. Verify that the circuit breaker has not tripped. **If it has tripped:** Reset the circuit breaker switch and try the power key again. **NOTE:** If the circuit breaker opens it may be reset only once. **If it did not trip:** Contact your dealer for further assistance.

The screen displays a BIT failure The display screen will display a warning message and degraded state indicator ⚠ if any of Stratus ES/ESG's BITs fail.	The Stratus ES/ESG screen might display a warning message with one of these instructions. See below for how to assess the failure: • **PRESS FUNC TO CLEAR**: A non-critical error has been detected. Stratus ES/ESG will run in a degraded state until the error is resolved. Contact your dealer for further assistance. • **PLEASE RESTART UNIT**: A critical error has been detected. Restarting the unit might fix the error. If the message returns after restarting, contact your dealer for further assistance. • **PLEASE SHUTDOWN UNIT**: A critical error has been detected. Power off the unit and do not turn it back on. Contact your dealer for further assistance. • **WAITING TO BE UNSTUCK**: A key has been depressed for more than 20 seconds. If a key is stuck, try to unstick the key. • **WAITING FOR RELEASE**: The external suppression input is constantly in a suppressed state. Contact your dealer for further assistance. • **ATTEMPTING TO RECOVER**: A squitter rate error has been detected. The transponder may recover itself, but if it does not, restart the unit. If the message returns after restarting, contact your dealer for further assistance.

Chapter 6. Performance

No change.

Chapter 7. Mass and Balance/Equipment Lists

See aircraft Weight & Balance information for current Basic Empty Weight, Center of Gravity (CG), and Moment.

FAA APPROVED
Date: SEP 20 2017

GARMIN Ltd. or its subsidiaries
c/o GARMIN International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA Approved
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT
as installed in

PIPER PA-28-180

Make and Model Airplane

Registration Number: N4923L Serial Number: 28-4289

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA01818WI for the installation and operation of the Garmin G5 Electronic Flight Instrument. This document must be carried in the airplane at all times.

The information contained herein supplements or supersedes the information made available to the operator by the aircraft manufacturer in the form of clearly stated placards or markings, 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 or markings, or the basic FAA approved Airplane Flight Manual.

FAA APPROVED BY: _____

Robert Murray
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

DATE: 12/20/2017

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Garmin International, Inc

Log of Revisions

FAA Approved AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

GARMIN G5 ELECTRONIC FLIGHT INSTRUMENT

REV NO.	PAGE NO(S)	DESCRIPTION	DATE OF APPROVAL	FAA APPROVED
1	ALL	Original Issue	7/22/2016	Robert Murray ODA STC Unit Administrator
2	ALL	Added information regarding G5 DG/HSI.	4/28/2017	Robert Murray ODA STC Unit Administrator
3	ALL	Added interface to 3rd party autopilots.	10/18/2017	Robert Murray ODA STC Unit Administrator
4	ALL	Added note to General section.	10/26/17	Paul Mast ODA STC Unit Administrator
5	ALL	Reformatted document. Updated system messages interface. Added DG/HSI reversion description.	See Cover	See Cover

Table of Contents

Abbreviations and Terminology

The following glossary is applicable within the airplane flight manual supplement

ADI	Attitude Direction Indicator
AFMS	Airplane Flight Manual Supplement
ATT	Attitude
CDI	Course Deviation Indicator
DG	Directional Gyro
DR	Dead Reckoning
FAA	Federal Aviation Administration
GPS	Global Positioning System
GPSS	GPS Roll Steering
HDG	Heading
HSI	Horizontal Situation Indicator
ILS	Instrument Landing System
LOC	Localizer (no glideslope available)
LOI	Loss of Integrity
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional Range

SECTION 2 – LIMITATIONS

System Software Requirements

The G5 must utilize the following or later FAA approved software versions for this AFMS revision to be applicable:

Component	Software Version
G5 Electronic Flight Instrument	5.00

Use of Secondary Instruments

The original type design approved instruments for airspeed, altitude and vertical speed remain the primary indications for these parameters.

If the G5 Electronic Flight Instrument is installed in place of the rate of turn indicator, the original type design approved instrument for attitude remains in the primary indication for attitude.

If the G5 Electronic Flight Instrument is installed in place of the directional gyro, the original type design approved instruments for attitude remains the primary indication for attitude.

NOTE:

For aircraft approved for VFR-only operations, the G5 Electronic Flight Instrument may be installed as an attitude indicator and rate of turn indicator.

Kinds of Operations

No Change.

SECTION 3 – EMERGENCY PROCEDURES

G5 Failure Indications

If a G5 function fails, a large red 'X' is typically displayed over the instrument(s) or data experiencing the failure. Upon G5 power-up, certain instruments remain invalid as equipment begins to initialize. All instruments should be operational within one minute of power-up. If any instrument remains flagged and it is not likely an installation related problem, the G5 should be serviced by a Garmin-authorized repair facility.

Attitude Failure

Attitude failure is indicated by removal of the sky/ground presentation, a red X, and a yellow "ATTITUDE FAIL" on the display.

Rate-of-turn and slip information will not be available.

1. Use standby instruments.
2. Seek VFR conditions or land as soon as practical.

Heading Failure, Loss of Magnetometer Data, or Magnetic Field Error

A heading failure, loss of magnetometer data, or magnetic field error is indicated by removal of the digital heading readout, a red X, and a yellow "HDG" on the display.

1. Use standby magnetic compass.

NOTE:

If the G5 DG/HSI has a valid GPS signal the G5 DG/HSI instrument will display the GPS track information in magenta.

GPS Failure

If GPS navigation receivers and/or navigation information are not available or invalid, the G5 will display Dead Reckoning mode (DR) or Loss of Integrity mode (LOI) on the HSI in the lower left corner.

If Alternate Navigation Sources (ILS, LOC, VOR) Are Available:

1. Use alternate navigation source.

If No Alternate Navigation Sources Are Available:

If DR is Displayed on HSI:

1. Use the amber CDI for course information.
2. Fly toward known visual conditions.

If LOI is Displayed on HSI:

1. Fly toward known visual conditions.

For aircraft equipped with a GAD 29B interfaced to an autopilot, GPSS will be displayed in amber text when GPSS emulation has been selected from the G5 menu.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.

Attitude Aligning

During system initialization, the G5 displays the message 'ALIGNING' over the attitude indicator. The G5 will typically display valid attitude within the first minute of power-up. The G5 can also align itself while taxiing and during level flight.

If the "ALIGNING" indication occurs during flight and attitude remains displayed, the attitude display is acceptable for use for flight in instrument conditions. The message will clear when the attitude solution is within the systems internal accuracy tolerances. It is recommended to maintain wings level to reduce the time for the system to align.

Attitude Aligning / Keep Wings Level

If the "ALIGNING KEEP WINGS LEVEL" indication occurs during flight, the G5 has detected an invalid attitude solution and will not display any attitude information.

1. Use standby instruments to maintain wings level flight. The system will display attitude when internal accuracy tolerances have been met.
2. If attitude does not return, seek VFR conditions or land as soon as practical.

Loss of Electrical Power to the G5 Display

In the event of a loss of aircraft electrical power to the G5 attitude display, the indicator will continue to function on its internal battery. If an internal battery is installed on the optional G5 HSI, the indicator will continue to function on the internal battery if aircraft power is lost. Internal battery endurance is indicated on the G5 display in hours and minutes. The charging symbol will be removed and the internal battery will not be charged.

In the event the G5 attitude display powers down, the optional G5 HSI will automatically revert to displaying attitude information. It will not revert back to the DG/HSI format if the G5 attitude unit regains power. The DG/HSI presentation may be selected from the G5 menu on the G5 DG/HSI unit after reversion to the attitude display.

Loss of Electrical Power to the GAD 29B (If Installed)

In the event of a loss of aircraft electrical power to the optional GAD 29B, the heading and course datum will be unavailable to the autopilot and the autopilot may deviate from the intended path or may disconnect. GPS flight plan course information may be displayed on the HSI and VFR will be displayed in amber text on the HSI. GPSS will be displayed in amber text, if GPSS mode is selected.

1. Deselect GPSS from the G5 menu and select a different autopilot mode.
2. Lateral GPS course guidance may only be used in VFR conditions.

SECTION 4 – NORMAL PROCEDURES

G5 Power Button and Knob

The G5 display will power on with the application of aircraft power. The G5 power button is used to turn the display on and off. Press and hold the power button to turn the display off.

The knob performs the following functions:

Press	Press to access the Menu. From the Menu, press to select the desired menu item. Press to accept the displayed value when editing numeric data or selecting from a list. Press to sync the heading or track bug for the HSI.
Turn	From the Menu, turn the Knob to move the cursor to the desired menu item. For the ADI, rotate to adjust the baro setting on the secondary altitude display. For the HSI, rotate to adjust the heading or track bug. Turn to select the desired value when editing numeric data or selecting from a list.

Backlight Intensity Adjustment

The power up state of the G5 backlight is in Auto adjustment mode.

To adjust the backlighting:

To select Manual mode from Auto mode:

1. While the unit is turned on, press the Power button.
2. Turn the knob to manually adjust the backlight intensity.
3. Press the knob to close the backlight page.

To select Auto mode from Manual mode:

1. While the unit is turned on, press the Power button.
2. Press the Power button again to select Auto.
3. Press the knob to close the backlight page.

Prior to Flight in Instrument Meteorological Conditions

1. Press the Power button on the G5 attitude indicator.
2. Verify the battery status indicator is green on the G5 attitude indicator.

Autopilot Operations with the G5 HSI

The G5 and optional GAD 29B offer various integration capabilities dependent upon the type of autopilot installed in a particular aircraft.

The G5 Electronic Flight Instrument installation in this aircraft provides the following autopilot functions (appropriate boxes will be checked):

- ☐ This installation does not interface with the autopilot (basic wing leveling autopilot or no autopilot is installed in the aircraft).
- ☐ A GAD 29B Adapter is installed in this aircraft.
  - ☐ Course / NAV Selection coupling to the autopilot.
  - ☐ Heading Bug coupling capability to the autopilot.
  - ☐ Roll Steering (GPSS) emulated via heading mode.

    OR
  - ☐ Roll Steering capable autopilot (GPSS menu function for emulation not applicable).

Course / NAV Selection Coupling to the Autopilot (If Configured)

When operating the autopilot in NAV mode, the deviation information from the installed navigation sources (i.e. GPS or NAV) is switched via the navigation source. The NAV source displayed on the HSI is the NAV source the autopilot is following. Many autopilots also use the course datum to determine the best intercept angles when operating in NAV mode.

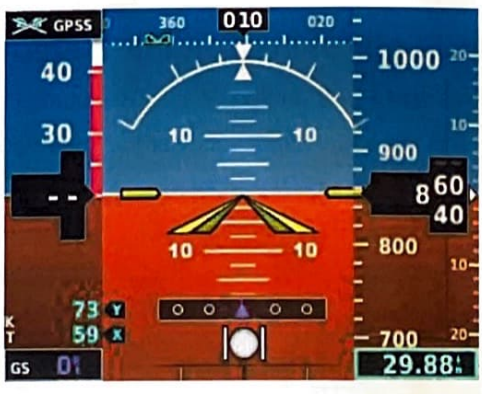
Heading Bug Coupling Capability to the Autopilot (If Configured)

When operating the autopilot in HDG mode, the difference between the HDG bug location on the HSI and the actual aircraft heading creates an error signal which the autopilot will minimize by turning in the direction of the bug. If the bug is turned more than 180 degrees, the autopilot may turn the airplane in the opposite direction of the desired turn.

Roll Steering (GPSS) Emulated via HDG Mode (If Configured)

For autopilots that do not support digital GPSS signals, GPSS functionality may be emulated by operating the autopilot in HDG mode and selecting GPSS from the G5 menu. If the autopilot is already designed to receive roll steering information, the data is transmitted digitally from the navigator to the autopilot.

When GPSS is selected on the G5 menu, the heading bug on the HSI changes to a hollow outline and a crossed-out heading bug appears on the G5 HSI display indicating that the autopilot is not coupled to the heading bug. The bug is still controllable and may still be used for reference.



When GPSS is selected on the G5, GPSS turn commands are converted into a heading error signal to the autopilot. When the autopilot is operated in HDG mode, the autopilot will fly the turn commands from the GPS

SECTION 7 – SYSTEM DESCRIPTION

Refer to Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev A (or later approved revisions), for a description of the G5 electronic flight instrument. This reference material is not required to be on board the aircraft but does contain a more in depth description of all the functions and capabilities of the G5.

The ATT circuit breaker supplies power to the G5 instrument for normal power operation and to charge the internal battery.

The DG circuit breaker supplies power to the G5 instrument for normal power operation when configured as a DG, and to charge the internal battery (if installed).

The HSI circuit breaker supplies power to the G5 instrument for normal power operation when configured as an HSI, and to charge the internal battery (if installed).

The GAD circuit breaker supplies power to the optional GAD 29 adapter for normal power operation.

System Messages

The G5 has the capability to display system messages to the crew along the bottom of the display. A system message is indicated through a white ! indication on the G5.

Messages can be displayed by pressing the G5 knob, and selecting the Message menu item.

(For Reference Only)