PFN NUMBER

SEPTEMBER 2004

STUDENT GUIDE

FOR

UH-60 COMMUNICATION AND NAVIGATION SYSTEM

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APRIL 2004

BLACK HAWK UH-60 COMMUNICATION AND NAVIGATION SYSTEM

TABLE OF CONTENTS

SECTION I. -INTRODUCTION

TERMINAL LEARNING OBJECTIVE:

At the completion of this lesson you will:

ACTION: Identify the characteristics of the UH-60 Communication and Navigation system.

CONDITIONS: As a UH-60 Maintenance test pilot.

STANDARD: In Accordance with (IAW) UH-60 Technical Manuals.

SAFETY REQUIREMENTS: Will be addressed as NOTES, CAUTIONS, and WARNINGS throughout the lesson outline.

RISK ASSESSMENT LEVEL: Low

ENVIRONMENTAL CONSIDERATIONS: There are no environmental concerns for this lesson.

EVALUATION: None

SECTION II. -PRESENTATION

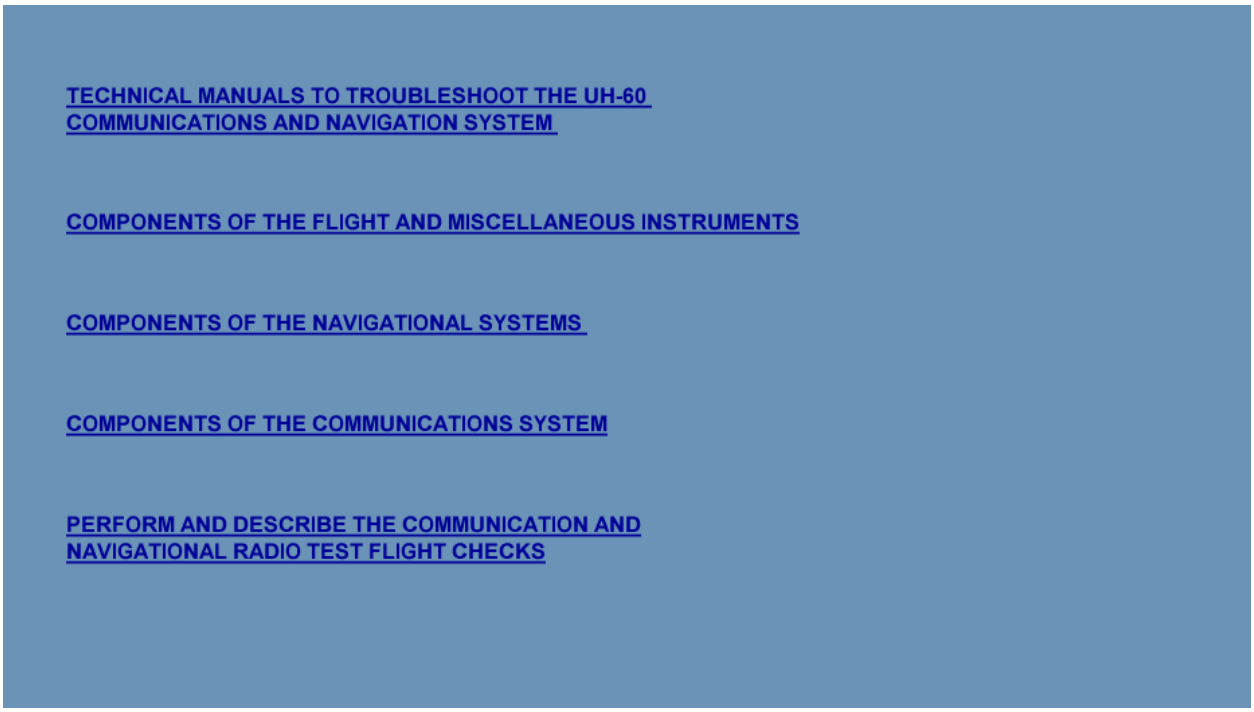
A. ENABLING LEARNING OBJECTIVE No.1:

ACTION: Identify the technical manuals required to troubleshoot the Communications and Navigational (Com/Nav) System of the UH-60.

CONDITION: As a UH-60 Maintenance test pilot.

STANDARD: In Accordance with (IAW) manuals TM 1-1500-204-23 (SERIES) Volume 4, TM 1-1520-237-23 (SERIES), TM 11-1520-237-23 (SERIES), TM 1-1520-237-MTF.

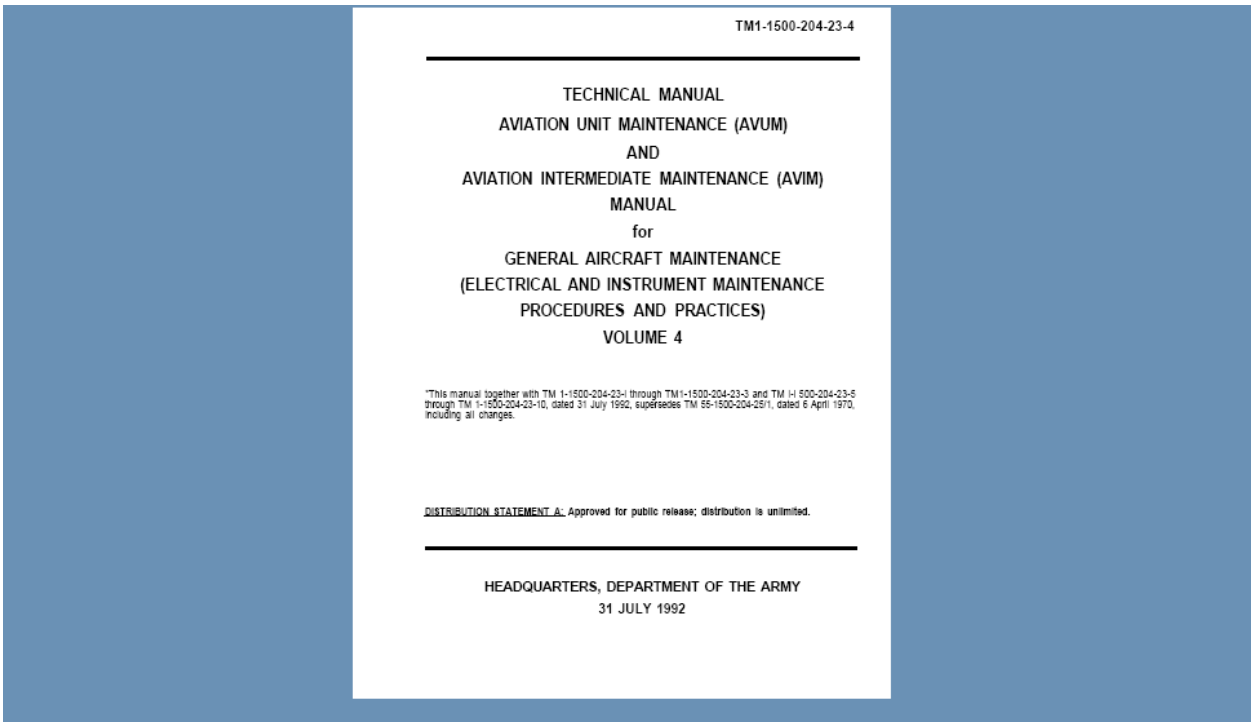
Frame #0015 (MENU)



Frame #1005 (Technical Manuals Overview)

a. TM 1-1500-204-23 (SERIES)

Frame #1010 (TM 1-1500-204-23 (SERIES)



TM1-1500-204-23-4

TECHNICAL MANUAL
AVIATION UNIT MAINTENANCE (AVUM)
AND
AVIATION INTERMEDIATE MAINTENANCE (AVIM)
MANUAL
for
GENERAL AIRCRAFT MAINTENANCE
(ELECTRICAL AND INSTRUMENT MAINTENANCE
PROCEDURES AND PRACTICES)
VOLUME 4

*This manual together with TM 1-1500-204-23-I through TM1-1500-204-23-3 and TM I-I 500-204-23-5 through TM 1-1500-204-23-10, dated 31 July 1992, supersedes TM 55-1500-204-25/1, dated 6 April 1970, including all changes.

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

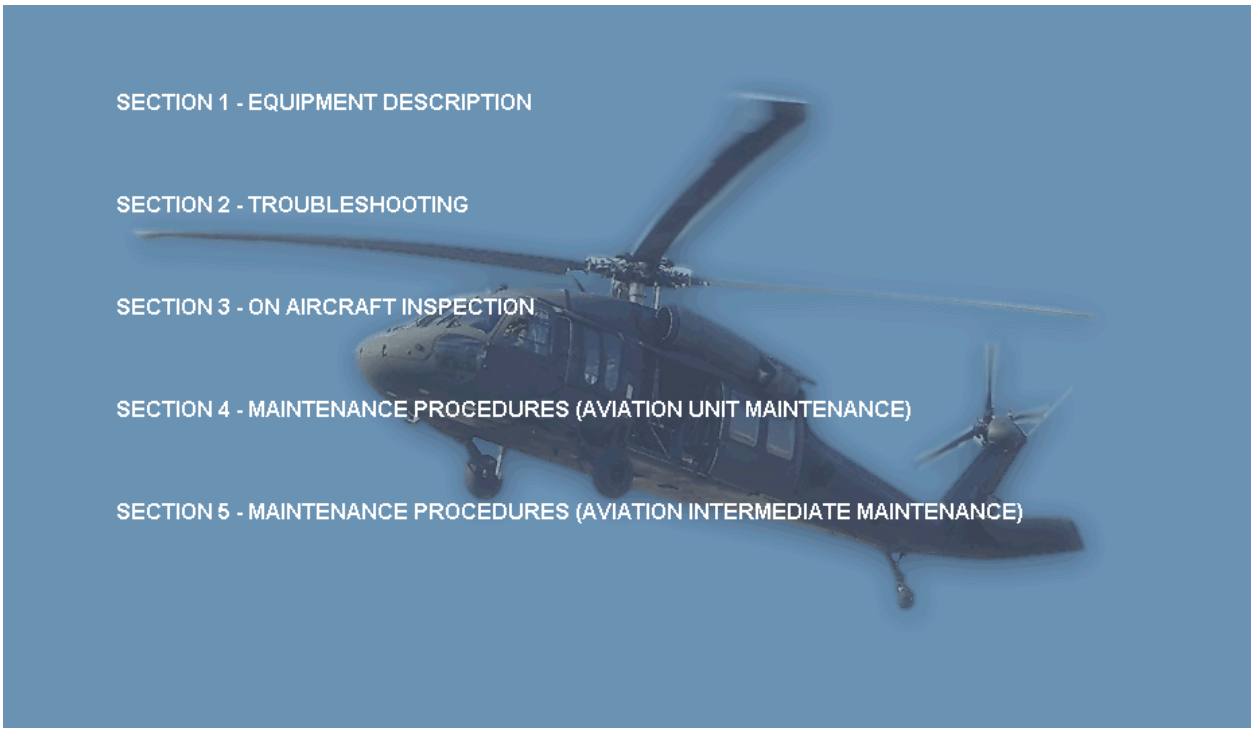
HEADQUARTERS, DEPARTMENT OF THE ARMY
31 JULY 1992

(1) The TM 1-1500-204-23 (series) manual is used for general aircraft maintenance.

(2) Volume 4 is the Electrical and Instrument maintenance procedures and practices that include Pitot-Static system test, Outside Air Temperature (OAT)/Free Air Temperature (FAT) gage test, and Magnetic Compass compensation.

b. TM 1-1520-237-23 (SERIES)

Frame #1015 (TM-1-1520-237-23 (Series)



(1) This series manual has general aircraft information on the UH-60 and is divided into 13 volumes. Each chapter is broken down into 5 sections.

(a) Section 1 – Equipment Description

(b) Section 2 – Troubleshooting

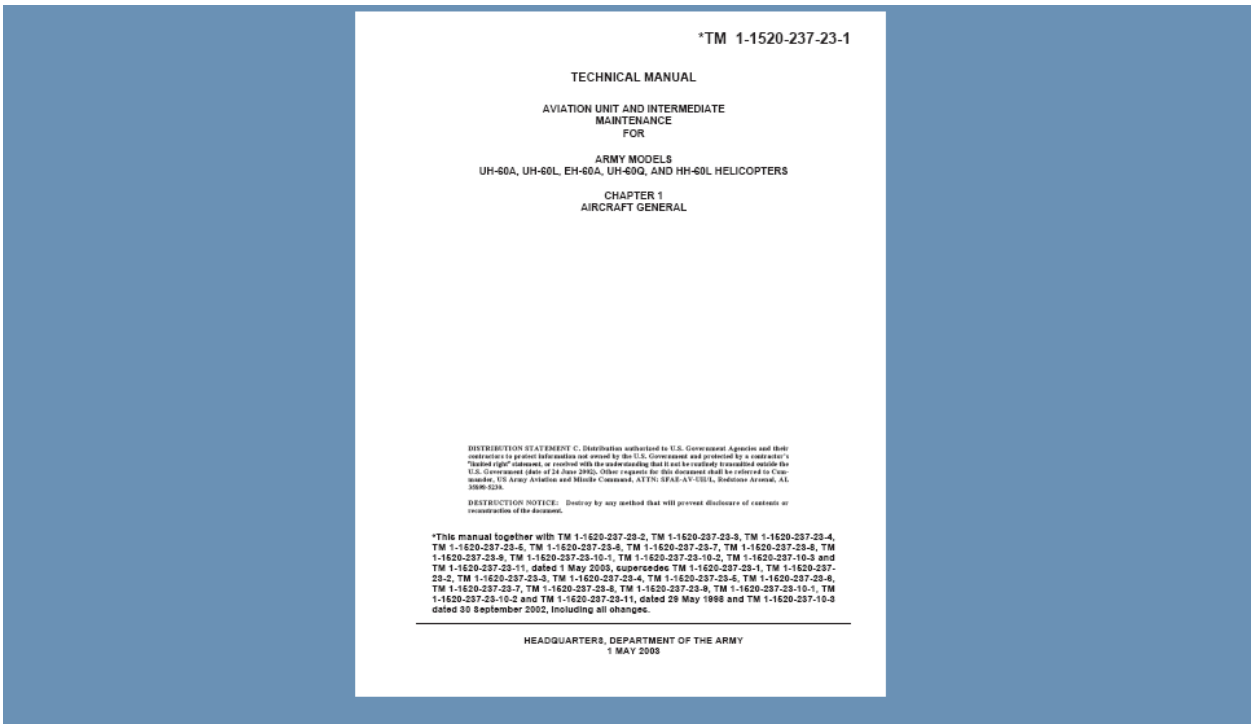
(c) Section 3 – On Aircraft Inspection

(d) Section 4 – Maintenance Procedures (Aviation Unit Maintenance)

(e) Section 5 – Maintenance Procedures (Aviation Intermediate Maintenance

c. TM-1-1520-237-23-1

Frame #1020 (TM 1-1520-237-23-1



*TM 1-1520-237-23-1

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE
FOR

ARMY MODELS
UH-60A, UH-60L, EH-60A, UH-60Q, AND HH-60L HELICOPTERS

CHAPTER 1
AIRCRAFT GENERAL

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government Agencies and their contractors to protect information not owned by the U.S. Government and protected by a contractor's "limited right" statement, or received with the understanding that it not be routinely transmitted outside the U.S. Government (date of 24 June 2002). Other requests for this document shall be referred to Commander, US Army Aviation and Missile Command, ATTN: SFAE-AV-UH-L, Redstone Arsenal, AL 35898-5230.

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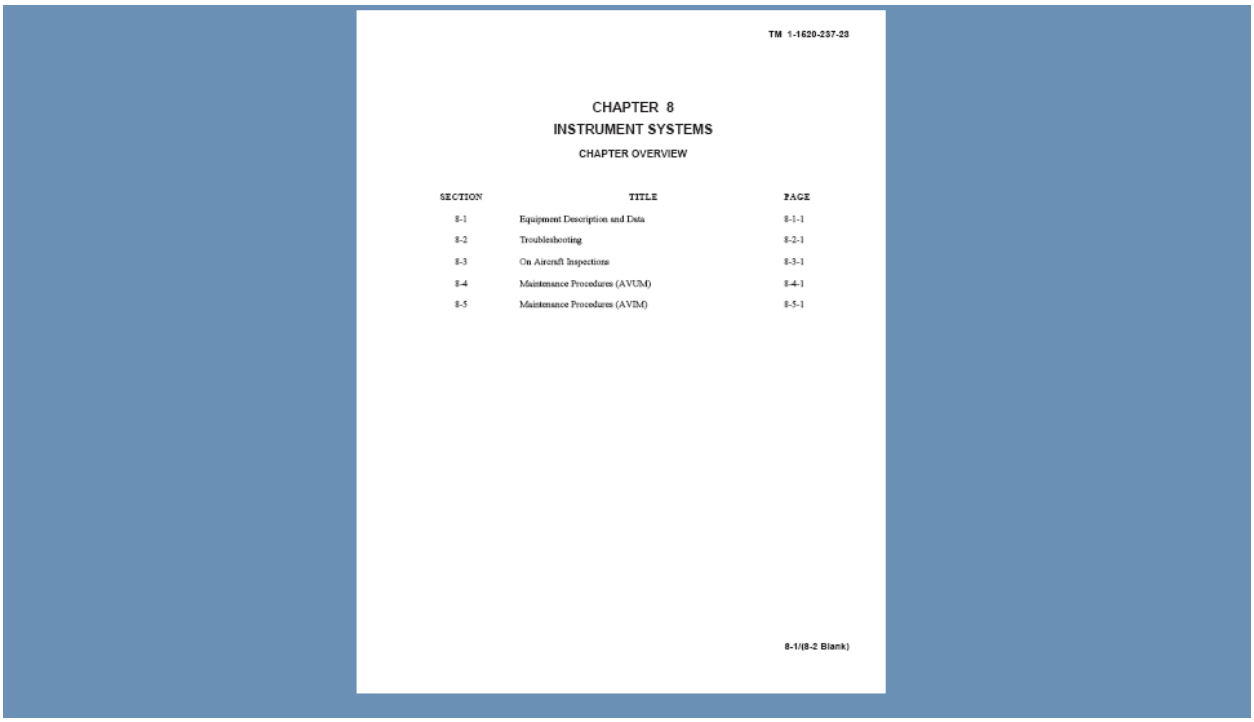
*This manual together with TM 1-1520-237-23-2, TM 1-1520-237-23-3, TM 1-1520-237-23-4, TM 1-1520-237-23-5, TM 1-1520-237-23-6, TM 1-1520-237-23-7, TM 1-1520-237-23-8, TM 1-1520-237-23-9, TM 1-1520-237-23-10-1, TM 1-1520-237-23-10-2, TM 1-1520-237-10-3 and TM 1-1520-237-23-11, dated 1 May 2003, supersedes TM 1-1520-237-23-1, TM 1-1520-237-23-2, TM 1-1520-237-23-3, TM 1-1520-237-23-4, TM 1-1520-237-23-5, TM 1-1520-237-23-6, TM 1-1520-237-23-7, TM 1-1520-237-23-8, TM 1-1520-237-23-9, TM 1-1520-237-23-10-1, TM 1-1520-237-23-10-2 and TM 1-1520-237-23-11, dated 29 May 1998 and TM 1-1520-237-10-3 dated 30 September 2002, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
1 MAY 2003

(1) This volume of TM 1-1520-237-23 (series) contains periodic/special inspections for compass indicators, pitot-static system, OAT/FAT, post lightning strike inspections and calendar retirement schedule.

d. TM 1-1520-237-23-4

Frame #1025 TM 1-1520-237-23-4



TM 1-1520-237-23

CHAPTER 8
INSTRUMENT SYSTEMS
CHAPTER OVERVIEW

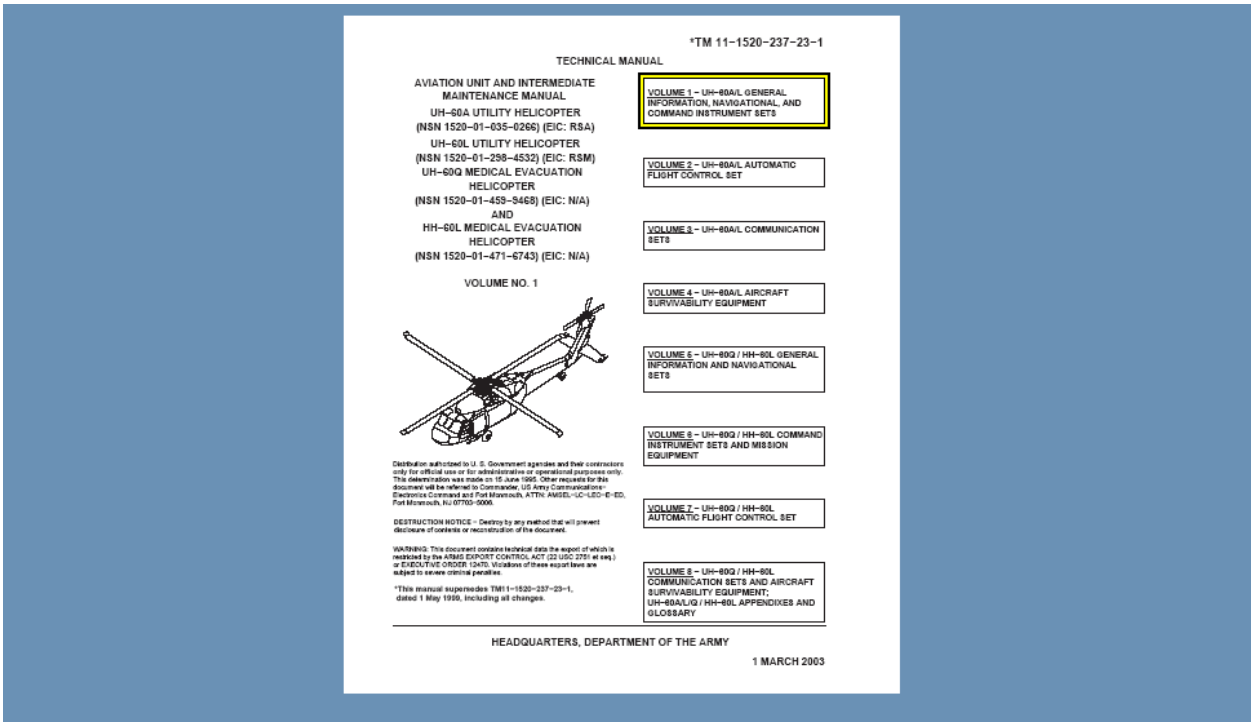
SECTION	TITLE	PAGE
8-1	Equipment Description and Data	8-1-1
8-2	Troubleshooting	8-2-1
8-3	On Aircraft Inspections	8-3-1
8-4	Maintenance Procedures (AVUM)	8-4-1
8-5	Maintenance Procedures (AVIM)	8-5-1

8-1/(8-2 Blank)

(1) Troubleshooting and maintenance procedures of the flight instrument systems and miscellaneous instruments are in chapter 8 of this manual.

e. TM 11-1520-237-23 (SERIES)

Frame #1030 (TM 11-1520-237-23 (SERIES)



*TM 11-1520-237-23-1

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL
UH-60A UTILITY HELICOPTER
(NSN 1520-01-035-0266) (EIC: RSA)
UH-60L UTILITY HELICOPTER
(NSN 1520-01-298-4532) (EIC: RSM)
UH-60Q MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-459-9468) (EIC: N/A)
AND
HH-60L MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-471-6743) (EIC: N/A)

VOLUME NO. 1

VOLUME 1 – UH-60A/L GENERAL INFORMATION, NAVIGATIONAL, AND COMMAND INSTRUMENT SETS

VOLUME 2 – UH-60A/L AUTOMATIC FLIGHT CONTROL SET

VOLUME 3 – UH-60A/L COMMUNICATION SETS

VOLUME 4 – UH-60A/L AIRCRAFT SURVIVABILITY EQUIPMENT

VOLUME 5 – UH-60Q / HH-60L GENERAL INFORMATION AND NAVIGATIONAL SETS

VOLUME 6 – UH-60Q / HH-60L COMMAND INSTRUMENT SETS AND MISSION EQUIPMENT

VOLUME 7 – UH-60Q / HH-60L AUTOMATIC FLIGHT CONTROL SET

VOLUME 8 – UH-60Q / HH-60L COMMUNICATION SETS AND AIRCRAFT SURVIVABILITY EQUIPMENT; UH-60A/L/Q / HH-60L APPENDIXES AND GLOSSARY

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*This manual supersedes TM 11-1520-237-23-1, dated 1 May 1999, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 MARCH 2003

(1) The 11 series manual is divided into 8 volumes.

(a) Volume 1

1) Volume 1 of this manual contains general helicopter information and descriptive information for the Navigation (NAV) and the Command Instrument Sets (CIS) on the UH-60A and the UH-60L.

2) They are the Civil Navigation, Low Frequency/Automatic Direction Finder (LF/ADF), Doppler, Gyromagnetic Compass, Attitude, Rate-of-Turn Indicating, CIS, Radar Altimeter, and Heads Up Display (HUD) Sets.

(b) Volume 2

1) Volume 2 of the manual contains descriptive information for the AFCS for the UH-60A and UH-60L.

2) They are: Analog Stability Augmentation (SAS), Digital Automatic Flight Control System (DAFCS), and Stabilator (STAB), and Stabilator System Test Panel (SSTP).

(c) Volume 3

1) .Volume 3 of the manual contains descriptive information for Communication (COMM) on the UH-60A and UH-60L.

2) They are: No. 1 and the No. 2 VHF/FM Radios, VHF/AM Radio, High Frequency (HF) Radio, and Intercommunication Set (ICS).

(d) Volume 4

1) Volume 4 contains descriptive information for Aircraft Survivability Equipment (ASE) on the UH-60A and UH-60L. They are: Transponder, Countermeasure, Radar Signal Detecting, and the Chaff Dispenser Sets.

(e) Volume 5 Through 7

1) Volume 5 through 7 contains general helicopter information for navigation and descriptive information for CIS, Mission Equipment, and AFCS for the UH-60Q and HH-60L.

(f) VOLUME 8

1) Volume 8 contains descriptive information for communication and ASE on the UH-60Q and HH-60L. Additionally, Volume 8 contains the Appendices and the Glossary for the UH-60A, UH-60L, UH-60Q, HH-60L.

f. TM11-1520-237-23-1 (VOLUME 1)

Frame #1035 (TM11-1520-237-23-1) (VOLUME 1)

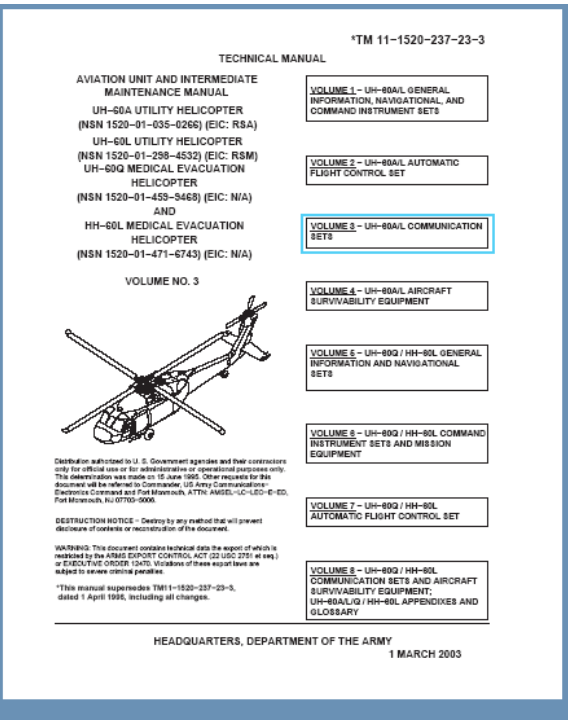
(1) Volume 1 of this manual is divided into 11 chapters which contains General Information, Navigational, and Command Instruments Sets.

(a) Chapter 1 – Introduction and General Description

(b) Chapter 2 through 11 – Very High Omniranging, Doppler and Doppler/Global Positioning Set(GPS), Command Instrument Set (CIS), Horizontal Situation Indicato/Vertical Situation Indicator (VSI) Mode Select Units, Gyro-magnetic set, Attitude indicating Set, Rate of Turn Indicator, Radar Altimeter.

g. TM 11-1520-237-23-3 (VOLUME 3)

Frame #1040 (TM 11-1520-237-23-3 (VOLUME 3)



*TM 11-1520-237-23-3

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL

UH-60A UTILITY HELICOPTER
(NSN 1520-01-035-0266) (EIC: RSA)
UH-60L UTILITY HELICOPTER
(NSN 1520-01-298-4532) (EIC: RSM)
UH-60Q MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-459-9468) (EIC: N/A)
AND
HH-60L MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-471-6743) (EIC: N/A)

VOLUME NO. 3

VOLUME 1 – UH-60A/L GENERAL INFORMATION, NAVIGATIONAL, AND COMMAND INSTRUMENT SETS

VOLUME 2 – UH-60A/L AUTOMATIC FLIGHT CONTROL SET

VOLUME 3 – UH-60A/L COMMUNICATION SETS

VOLUME 4 – UH-60A/L AIRCRAFT SURVIVABILITY EQUIPMENT

VOLUME 5 – UH-60Q / HH-60L GENERAL INFORMATION AND NAVIGATIONAL SETS

VOLUME 6 – UH-60Q / HH-60L COMMAND INSTRUMENT SETS AND MISSION EQUIPMENT

VOLUME 7 – UH-60Q / HH-60L AUTOMATIC FLIGHT CONTROL SET

VOLUME 8 – UH-60Q / HH-60L COMMUNICATION SETS AND AIRCRAFT SURVIVABILITY EQUIPMENT; UH-60A/L/Q / HH-60L APPENDIXES AND GLOSSARY

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*This manual supersedes TM11-1520-237-23-3, dated 1 April 1996, including all changes.

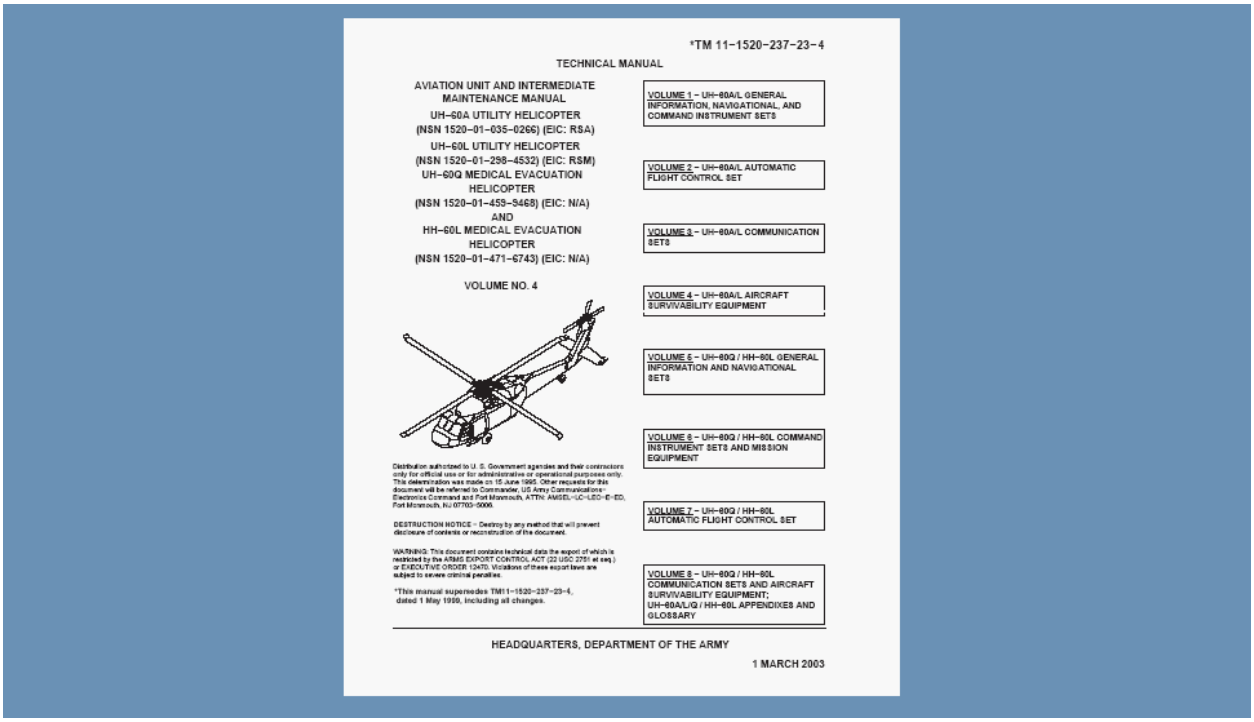
HEADQUARTERS, DEPARTMENT OF THE ARMY
1 MARCH 2003

(1) Volume 3 is used with the UH-60A/L communication sets and is divided into chapters 15 through 19.

(2) This volume contains the No. 1 and the No. 2 Very High Frequency (VHF)/Frequency Modulation (FM), VHF/Amplitude Modulation (AM), Ultra High Frequency (UHF) radios and the Intercommunications Set (ICS) system.

h. TM 11-1520-237-23-4 (VOLUME 4)

Frame #1045 (TM 11-1520-237-23-4) (VOLUME 4)



*TM 11-1520-237-23-4

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL
UH-60A UTILITY HELICOPTER
(NSN 1520-01-035-0266) (EIC: RSA)
UH-60L UTILITY HELICOPTER
(NSN 1520-01-298-4532) (EIC: RSM)
UH-60Q MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-459-9468) (EIC: N/A)
AND
HH-60L MEDICAL EVACUATION HELICOPTER
(NSN 1520-01-471-6743) (EIC: N/A)

VOLUME NO. 4

VOLUME 1 – UH-60A/L GENERAL INFORMATION, NAVIGATIONAL, AND COMMAND INSTRUMENT SETS

VOLUME 2 – UH-60A/L AUTOMATIC FLIGHT CONTROL SET

VOLUME 3 – UH-60A/L COMMUNICATION SETS

VOLUME 4 – UH-60A/L AIRCRAFT SURVIVABILITY EQUIPMENT

VOLUME 5 – UH-60Q / HH-60L GENERAL INFORMATION AND NAVIGATIONAL SETS

VOLUME 6 – UH-60Q / HH-60L COMMAND INSTRUMENT SETS AND MISSION EQUIPMENT

VOLUME 7 – UH-60Q / HH-60L AUTOMATIC FLIGHT CONTROL SET

VOLUME 8 – UH-60Q / HH-60L COMMUNICATION SETS AND AIRCRAFT SURVIVABILITY EQUIPMENT; UH-60A/L/Q / HH-60L APPENDIXES AND GLOSSARY

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*This manual supersedes TM 11-1520-237-23-4, dated 1 May 1999, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 MARCH 2003

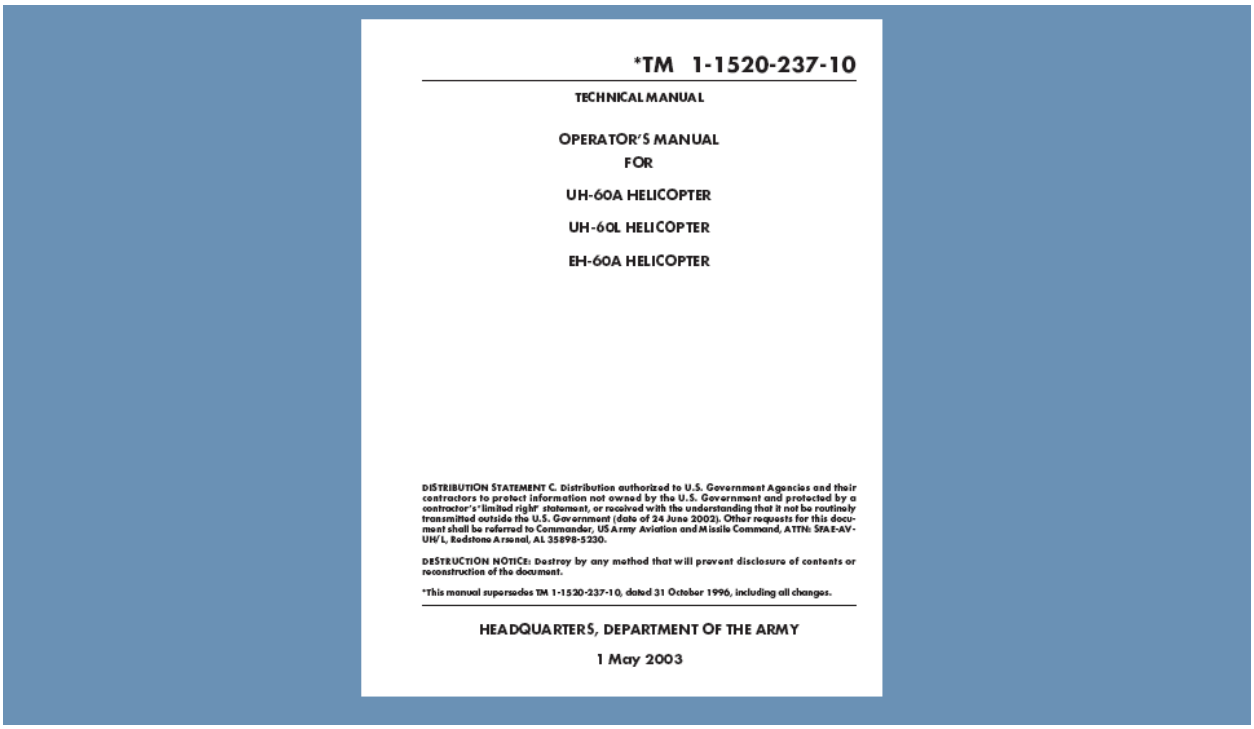
(1) The TM 11-1520-237-23-4 (Volume 4) provides information for the UH-60A/L ASE.

(2) The ASE is divided into chapters 20 through 23A.

(3) The information in these chapters covers the transponders ALQ-144, APR-39A(V1)/APR-39, and the M-130.

i. TM 1-1520-237-10

Frame #1050 (TM 1-1520-237-10)



*TM 1-1520-237-10

TECHNICAL MANUAL

OPERATOR'S MANUAL
FOR

UH-60A HELICOPTER

UH-60L HELICOPTER

EH-60A HELICOPTER

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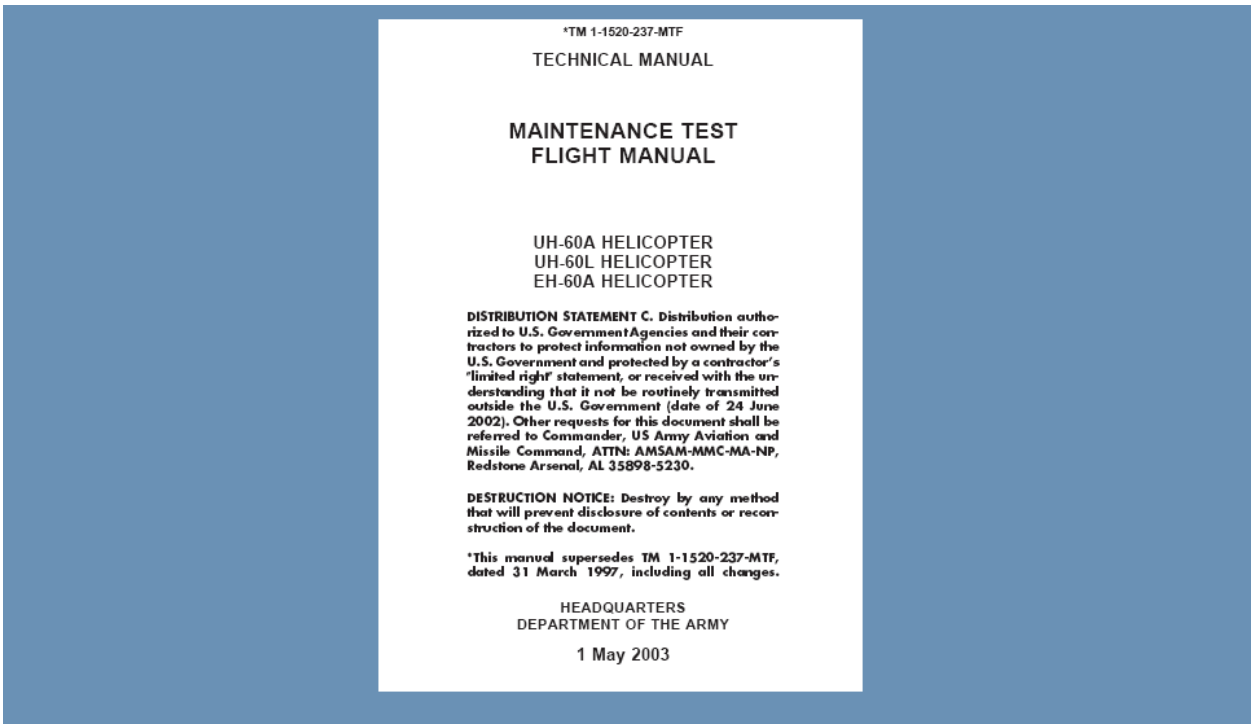
HEADQUARTERS, DEPARTMENT OF THE ARMY

1 May 2003

(1) The information in the TM 1-1520-237-10 covers the pilot information and procedures.

j. TM 1-1520-237-MTF

Frame #1055 (TM 1-1520-237-MTF)



*TM 1-1520-237-MTF

TECHNICAL MANUAL

MAINTENANCE TEST
FLIGHT MANUAL

UH-60A HELICOPTER
UH-60L HELICOPTER
EH-60A HELICOPTER

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***This manual supersedes TM 1-1520-237-MTF, dated 31 March 1997, including all changes.**

HEADQUARTERS
DEPARTMENT OF THE ARMY

1 May 2003

(1) The TM 1-1520-237-MTF contains the maintenance test flight procedures, which include the ground checks as well as the in-flight checks.

Check on Learning

1. How many volumes is the TM 1-1500-237-23 (series) manual is divided into?

2. What volume of the TM 11-1520-237-23 (series) manual contains descriptive information for the AFCS?

3. What manual contains the maintenance test flight procedures?

SECTION III. -SUMMARY

1. REVIEW/SUMMARIZE:

You have completed the technical manuals required to troubleshoot the Communication and Navigational systems lesson for the UH-60 helicopter.

The key points to remember are:

- The TM 1-1500-204-23 (series) manual is used for general aircraft maintenance and is divided into 13 volumes.
- Chapter 8 of volume 4 of the TM 1-1520-237-23 (series) manual contains troubleshooting and maintenance procedures of the flight instruments and miscellaneous instruments.
- General helicopter information for NAV and descriptive information for CIS, Mission Equipment and AFCS for the UH-60Q and HH-60L is covered in volume 1 of the TM 11-1520-237-23(series) manual.
- Volume 2 of the TM 11-1520-237-23 (series) manual contains descriptive information for the AFCS for the UH-60A and UH-60L.
- The Appendices and the Glossary for the UH-60A, UH-60L, UH-60Q, HH-60L are contained in volume 8 of the TM 11-1520-237-23 (series) manual.
- The TM 11-1520-237-23-1 (volume 1) is divided into 11 chapters which contains general information, Navigational and Command Instrument Sets.
- Pilot information and procedures are in the TM 1-1520-237-10.
- The TM 1-1520-237-MTF contains the maintenance test flight procedures, which include the ground checks as well as the in-flight checks.

B. ENABLING LEARNING OBJECTIVE ELO No.2

ACTION: Identify the components of flight and miscellaneous instruments.

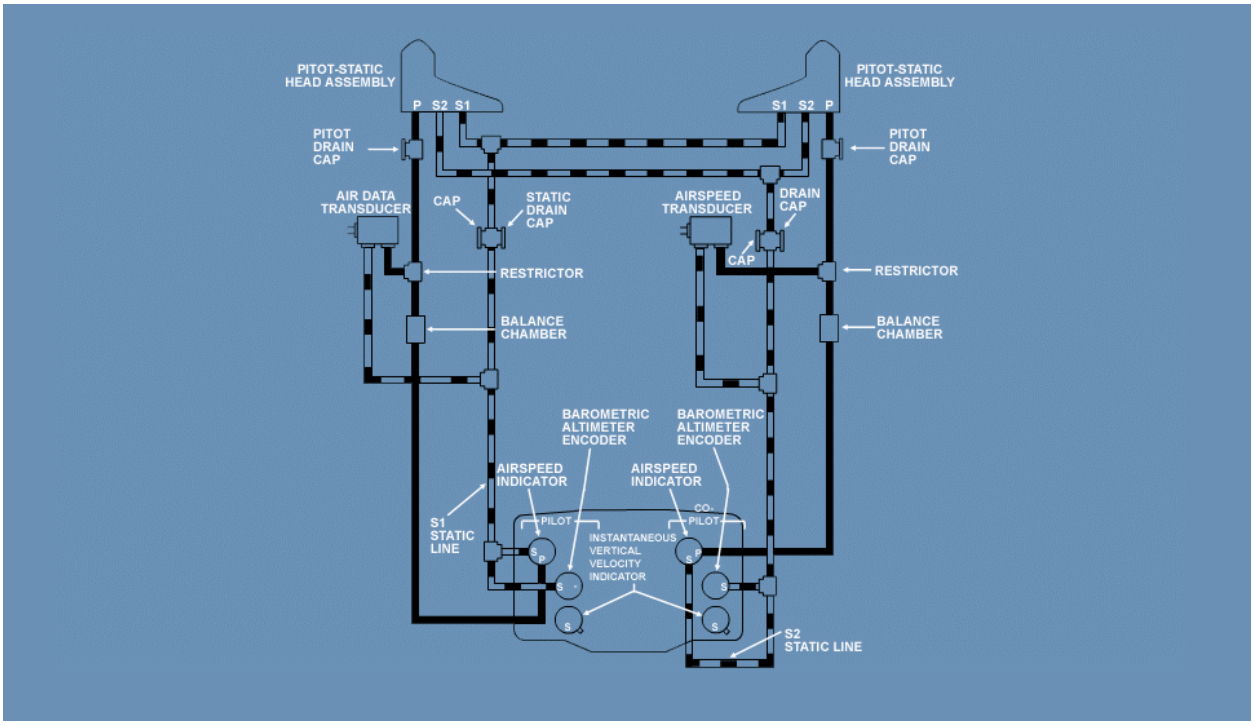
CONDITIONS: Given TM 1-1520-237-23-4.

STANDARDS: IAW TM 1-1520-237-23-4.

Frame #2002 (Components and Miscellaneous Instruments Menu)

a. PITOT-SATIC SYSTEM

Frame #2005 (PITOT-SATIC SYSTEM)



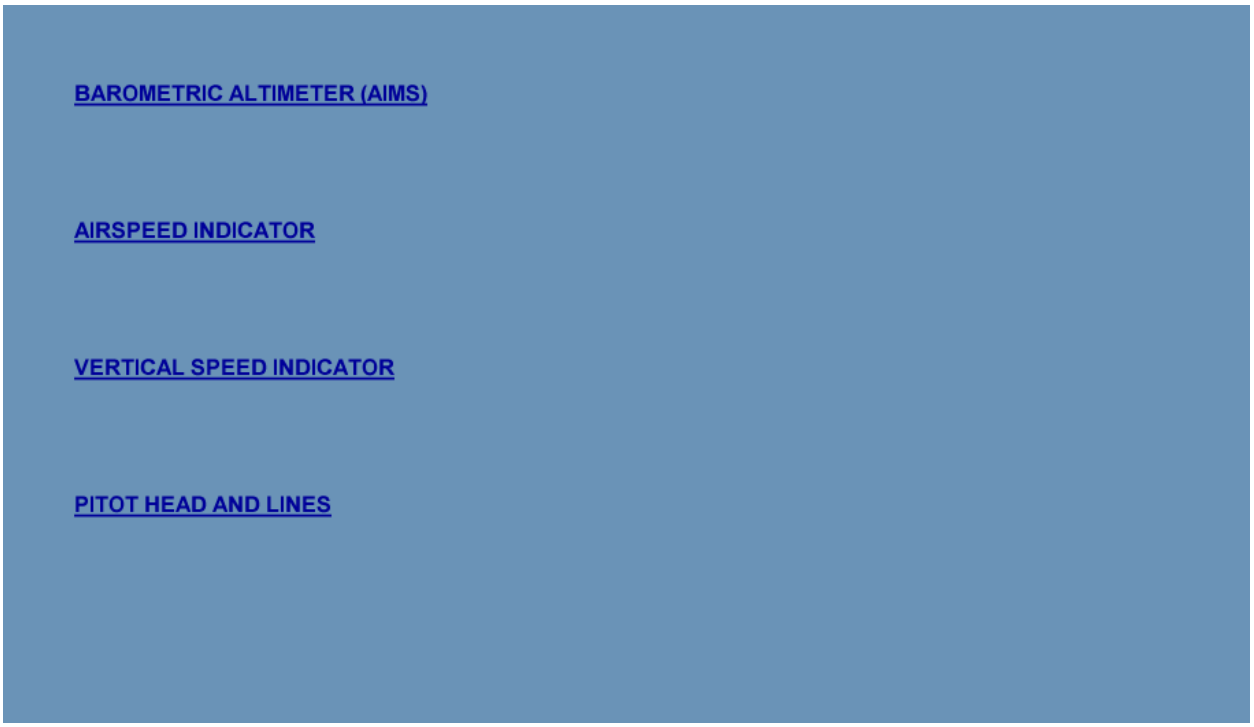
(1) The Pitot-static system provides pressure for operation of the differential pressure instruments, which are the altimeters, airspeed indicators, and vertical speed indicators (without MWO 50-42).

(2) Differential pressure used to actuate these instruments is created either by impact (Pitot) and static, or by static and trapped air pressures.

(3) The Pitot-static system supplies both Pitot and static pressures to the instruments.

(a) Pitot-Static System Components

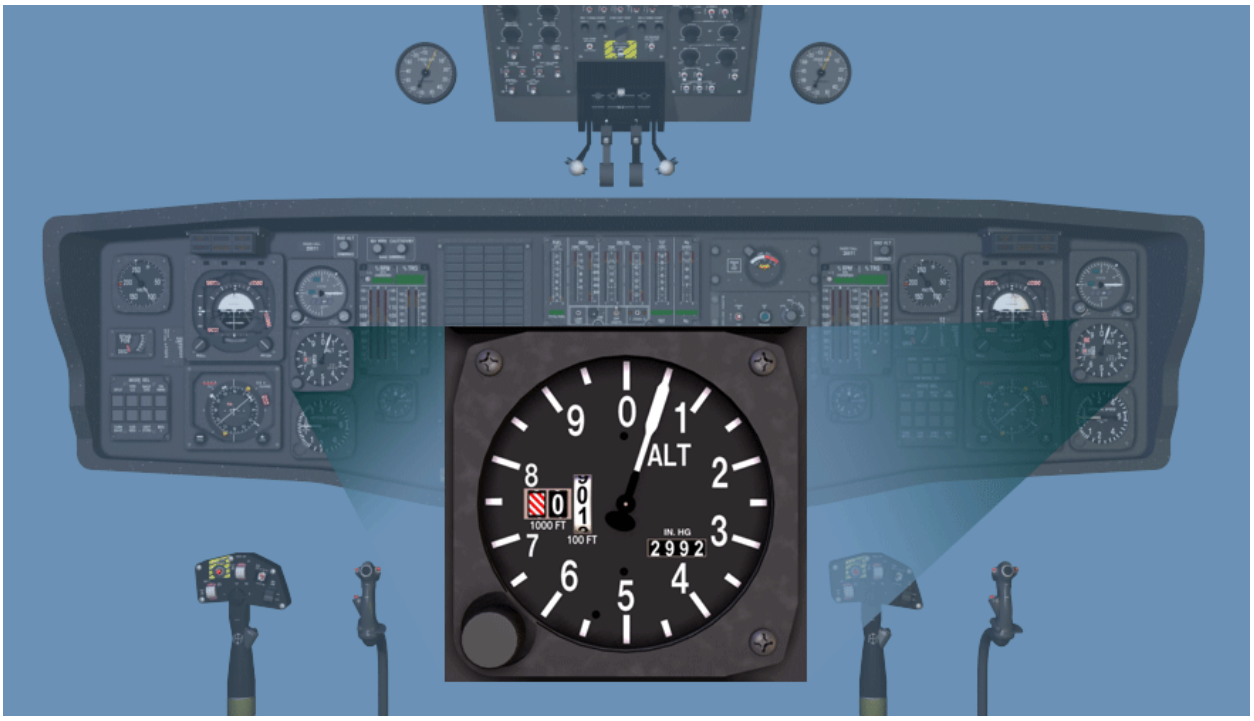
Frame #2010 (Pitot-Static System Components)



1) The airspeed indicators, vertical velocity indicators, barometric altimeters, pitot-static head assemblies, air data transducers, and pitot-static lines are some of the components that make up the pitot-static system.

a) BAROMETRIC ALTIMETER

Frame #2011 (BAROMETRIC ALTIMETER)



1 Two indicators, one on each side of the instrument panel, indicate altitude above or below sea level under standard conditions of temperature and atmospheric pressure.

2 The range of the altimeter is between -1000 to 50,000 feet as indicated by three drum indicators and a pointer.

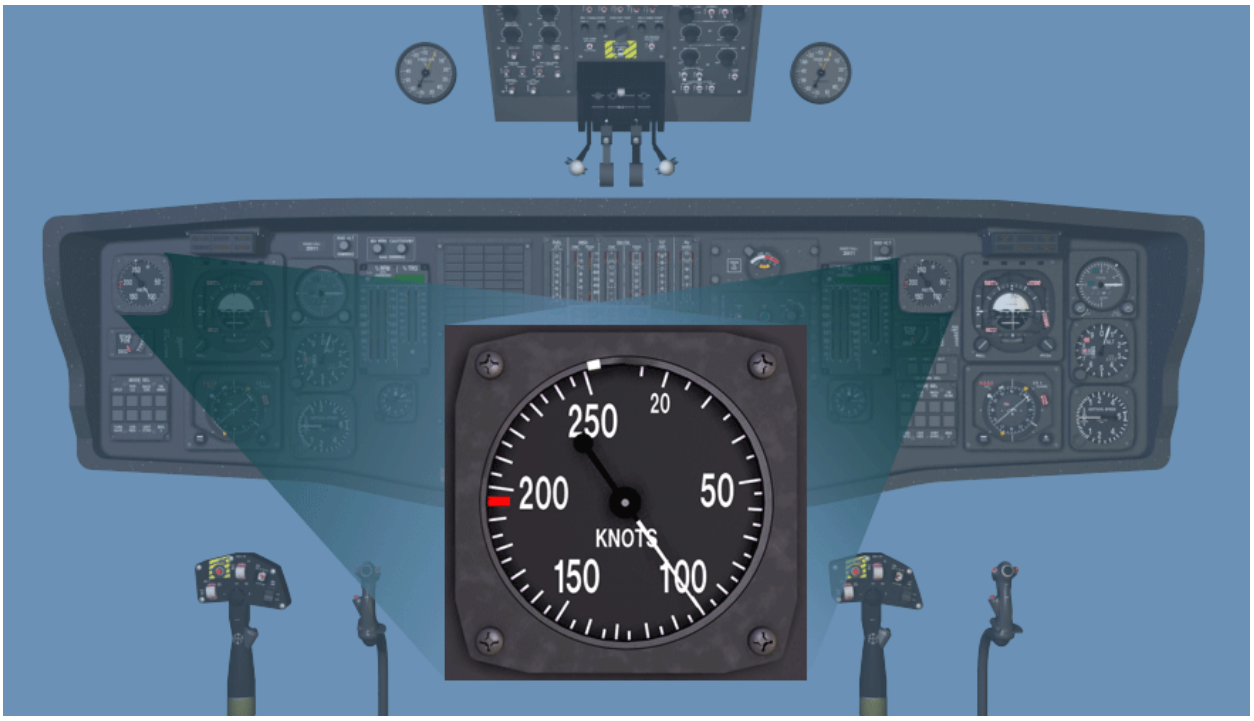
3 The electrical connector provides a 28 V dc input to an internal vibrator that decreases the friction in the mechanism.

4 The pilot altimeter encoder provides a digital output of pressure altitude to the transponder set (AN/APX-100).

5 The Pilot and the Co-pilot altimeters are not interchangeable.

b) AIRSPEED INDICATOR

Frame #2012 (AIRSPEED INDICATOR)



1 Two airspeed indicators, one on each side of the instrument panel, indicate helicopter speed in knots.

2 The range is between 0 to 250 knots, marked in 5 knot units.

3 The indicators are differential pressure instruments, measuring the difference between impact pressure and static pressure.

c) VERTICAL VELOCITY INDICATOR

Frame #2013 (VERTICAL VELOCITY INDICATOR)

1 Two vertical velocity indicators, one on each side of the instrument panel, indicate helicopter rate of ascent or descent in feet per minute (fpm).

2 Range markings begin at level flight and are in increments of 100 fpm until 1000 fpm and units above 1000 fpm units are in 500 fpm increments.

3 Maximum indicated vertical speed is 6000 fpm.

4 Indicator operation is controlled by pressure differential between two chambers.

5 A diaphragm-type chamber is connected to the static line. On UH60A 82-23748 - SUBQ UH60L, EH60A MWO (Maintenance Work Order) 50-42, UH60Q, HH-60L, the vertical velocity indicator is vented to cockpit atmosphere.

6 The other chamber is the instrument case itself, connected by an air-restricting tube to the internal connection of the diaphragm supply line.

7 The pointer may be zeroed externally by the adjusting screw in the lower left corner of the indicator.

d) PITOT HEAD AND LINES

Frame #2014 PITOT HEAD AND LINES

1 The pitot-static head assembly consists of a baseplate with a strut and probe tube.

2 Static 1 and Static 2 (S1 and S2) pressure is sensed at the contoured midsection of the tube.

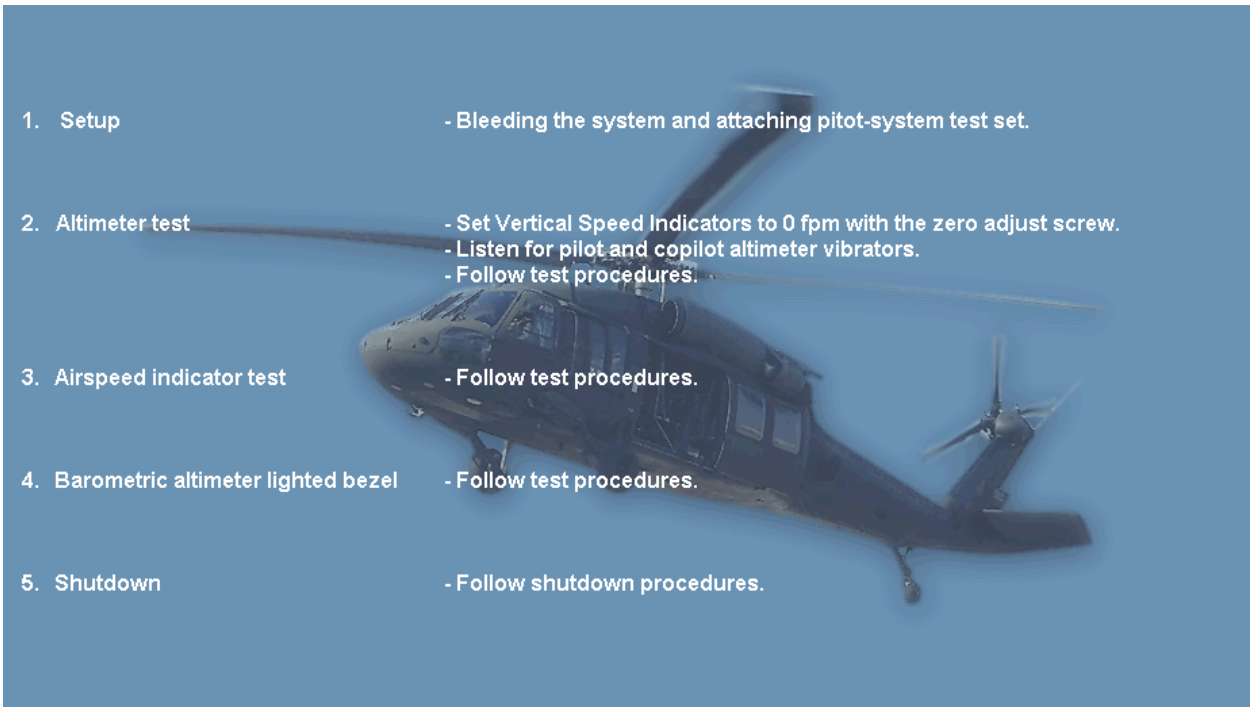
3 The base plate contains the pitot tube fitting, two static tube fittings, S1 and S2, and an electrical connector wired to two de-icing heaters in the tube.

4 The probe tube contains these pressure sensing ports: pitot, static 1, and static 2.

5 Pitot pressure is sensed at the opening of the front end of the tube.

(b) PITOT-STATIC SYSTEM TESTING AND TROUBLESHOOTING

Frame #2015 (PITOT-STATIC SYSTEM TESTING AND TROUBLESHOOTING)



1) There are 5 steps in performing an operational test and troubleshooting the pitot-static system.

a) Setup

1 Bleeding the system and attaching pitot-system test set.

b) Altimeter test

1 Set Vertical Velocity Indicators to 0 fpm with the zero adjust screw.

2 Listen for pilot and copilot altimeter vibrators.

3 Follow test procedures.

c) Airspeed indicator test

1 Follow test procedures.

d) Barometric altimeter lighted bezel

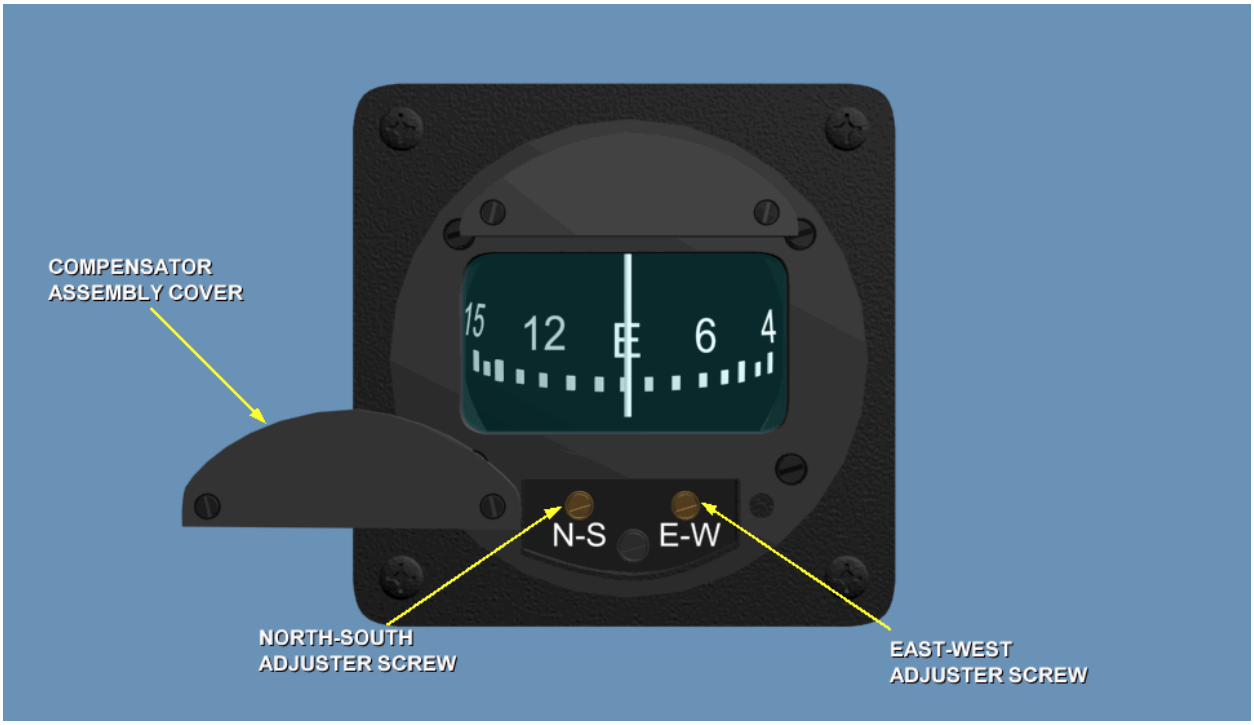
1 Follow test procedures.

e) Shutdown

1 Follow shutdown procedures.

b. STANDBY MAGNETIC COMPASS

Frame #2020 (STANDBY MAGNETIC COMPASS)



(1) The standby compass compensation must be completed when any of the following occurs: an engine change, modification or change to the electrical system, major structural changes, compass is suspected of being in error, flux valve loose, removed or replaced, and every 12 months.

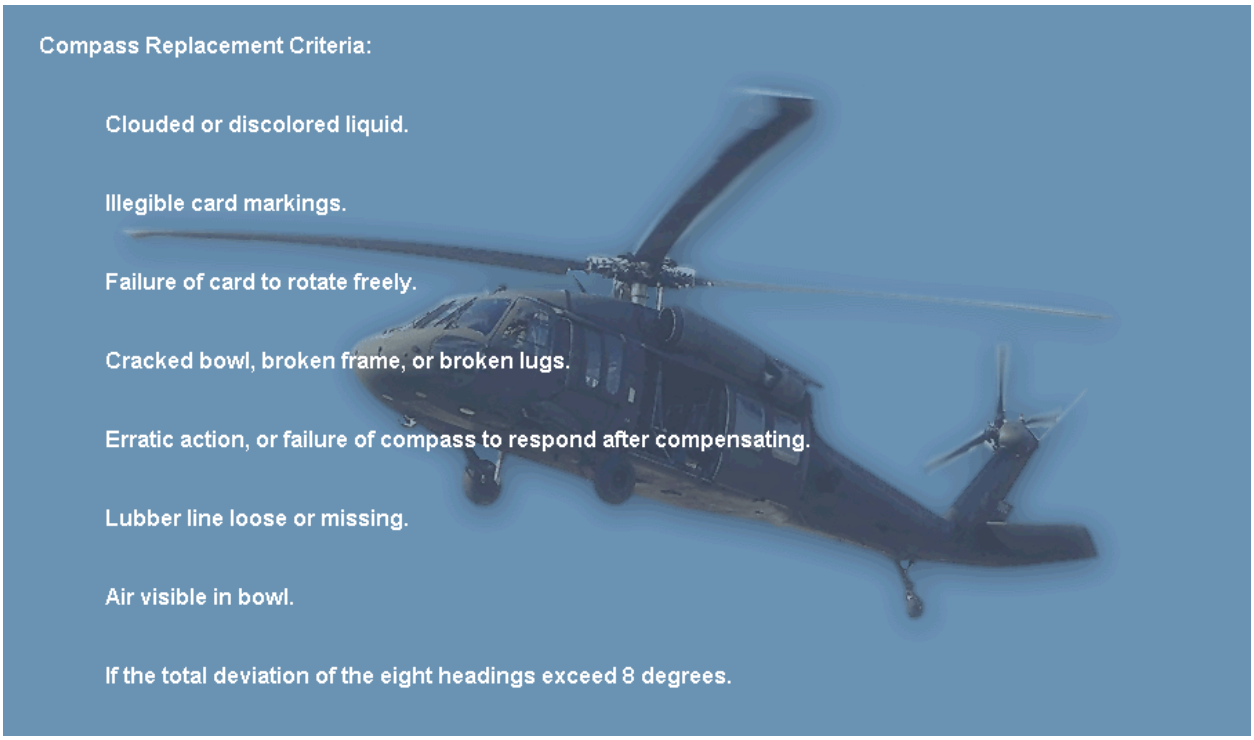
(2) The reason for compensation is also due to magnetic variation or deviation.

(3) Deviation is the disturbances from aircraft components which deflect the compass.

(4) Variation is the angular difference between the geographic North Pole and the magnetic north pole.

(a) Compass Replacement Criteria

Frame #2021 (Compass Replacement Criteria)



1) Clouded or discolored

2) Illegible card markings

3) Failure of card to rotate freely

4) Cracked bowl, broken frame or broken lugs

5) Erratic action, or failure of compass to respond after compensating

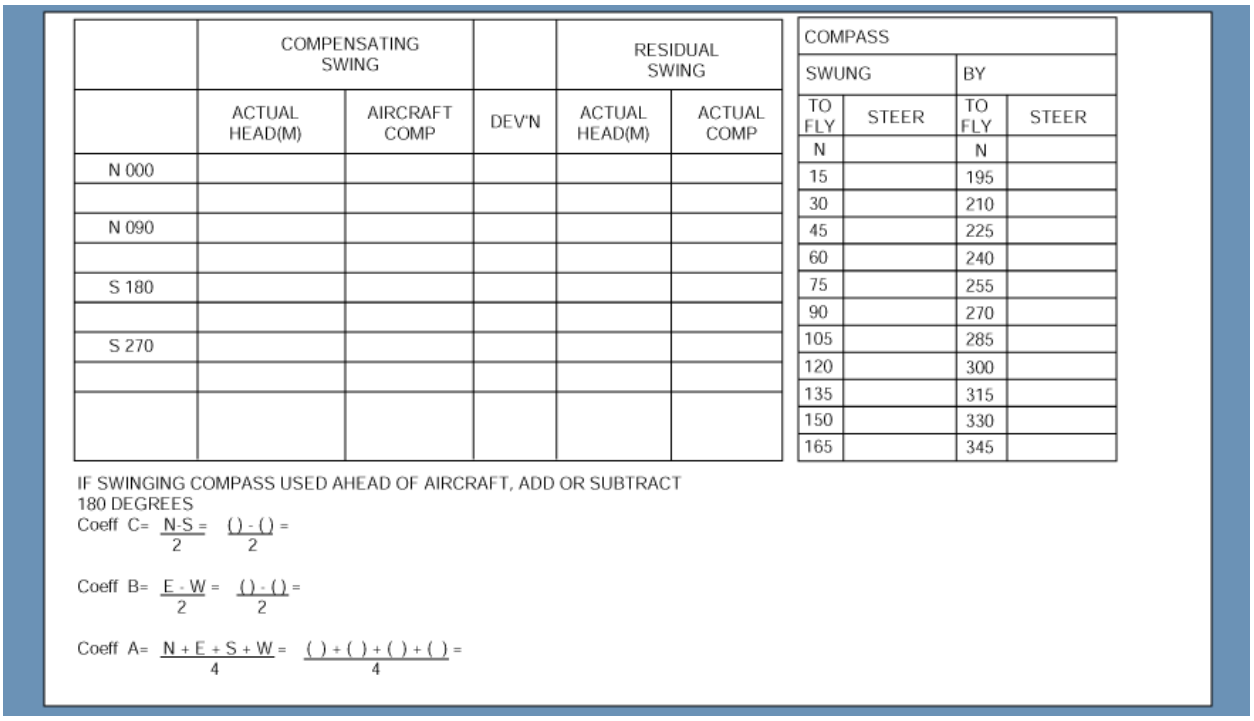
6) Lubber line loose or missing

7) Air visible in bowl

8) If total deviation of the eight headings exceed 8 degrees

(b) Standby Compass Deviation Card

Frame #2025 (STANDBY COMPASS DEVIATION CARD)



	COMPENSATING SWING			RESIDUAL SWING	
	ACTUAL HEAD(M)	AIRCRAFT COMP	DEV'N	ACTUAL HEAD(M)	ACTUAL COMP
N 000					
N 090					
S 180					
S 270					

COMPASS			
SWUNG		BY	
TO FLY	STEER	TO FLY	STEER
N		N	
15		195	
30		210	
45		225	
60		240	
75		255	
90		270	
105		285	
120		300	
135		315	
150		330	
165		345	

IF SWINGING COMPASS USED AHEAD OF AIRCRAFT, ADD OR SUBTRACT 180 DEGREES

Coeff C= $\frac{N-S}{2} = \frac{(\ ) - (\ )}{2} =$

Coeff B= $\frac{E - W}{2} = \frac{(\ ) - (\ )}{2} =$

Coeff A= $\frac{N + E + S + W}{4} = \frac{(\ ) + (\ ) + (\ ) + (\ )}{4} =$

1) To reduce the effect of deviation, the aircraft compass must be checked and compensated periodically by adjusting the compensating magnets.

2) This procedure is called a compass swing.

3) During compensation, the compass is checked at 15 degree increments.

4) Adjustments are made at each of these points, and the difference between magnetic heading and compass heading is shown on a compass correction card (DD FORM 1613).

5) When flying compass headings, the pilot must refer to the compass correction card and make the appropriate adjustment for the desired heading.

6) To preserve accuracy, ensure that no metallic objects such as flashlights or sunglasses are placed near the compass because they may induce significant errors.

7) The form number is DD FORM 1613 also contains the formulas for each of the coefficients to allow ease of calculations during the compass swing.

(c) Preparation For Compass Swing

Frame #2026 (PREPARATION FOR COMPASS SWING)

- Ensure aircraft is at least 100 yards from steel structures, underground cables, metal pipe, reinforced concrete, and other aircraft.
- Ensure that all items in the aircraft containing ferrous materials are located in the positions they will occupy during flight.
- Remove all magnetic articles from yourself. Use non-magnetic screwdriver for adjustments.
- Use a small permanent magnet to cause the compass card to deflect through a small angle. Note that the path of rotation is in a horizontal plane. During the swing, read the compass at the same angle to avoid errors.
- Run engines and turn on power to all electrical equipment, which would be on in normal flight.
- Prior to compass compensation swing, have aircraft headed successively toward magnetic North, East, South, and West. If compass readings are within 2 degrees of deviations noted on old compass card (DD Form 1613) transcribe old deviations to new DD Form 1613. Compass compensation is not required. If compass is not within 2 degrees, compensation is required.
- During compass compensation, one retaining screw must be removed and loosen the other from the compensator assembly cover, and rotate the cover to allow access to adjuster screws. Ensure that compensator adjuster screws are set to neutral prior to adjustments.

1) During the preparation for a compass swing, the procedures above must be followed to ensure that the compass is properly calibrated.

2) The different compass compensation methods are the master sighting compass method, INS method, in-flight method, and compass rose method.

3) During the inflight method, there are no adjustments completed while in flight.

   a) Ensure aircraft is at least 100 yards from steel structures, underground cables, metal pipe, reinforced concrete, and other aircraft.

   b) Ensure that all items in the aircraft containing ferrous materials are located in the positions they will occupy during flight.

   c) Remove all magnetic articles from yourself.

   d) Use non-magnetic screwdriver for adjustments.

   e) Use a small permanent magnet to cause the compass card to deflect through a small angle. Note that the path of rotation is in a horizontal plane. During the swing, read the compass at the same angle to avoid errors.

f) Run engines and turn on power to all electrical equipment, which would be on in normal flight.

g) Prior to a compass swing, have the aircraft headed successively toward magnetic North, East, South, and West. If compass readings are within 2 degrees of deviations noted on old compass card (DD Form 1613), transcribe old deviations to new DD Form 1613. Compass compensation is not required. If compass is not within 2 degrees, compensation is required.

h) During compass compensation, one retaining screw must be removed. Loosen the other screw from the compensator assembly cover, and rotate the cover to allow access to adjuster screws. Ensure that compensator adjuster screws are set to neutral prior to adjustments.

(d) Compass Swing Procedures

Frame #2027 (Compass Swing Procedures)

- Park helicopter on compass rose with nose pointing toward magnetic north. Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 8°.
- Turn helicopter on compass rose with nose pointing toward east. Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 86°.
- Turn helicopter on compass rose with nose pointing toward south. Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 176°.
- Turn helicopter on compass rose with nose pointing toward west. Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 278°.
- Subtract ACFT COMP value from ACTUAL HEAD (M) value for N, E, S, and W. Record result in DEVIATION column (ACTUAL HEAD (M) - ACFT COMP = DEVIATION).
- Turn helicopter on compass rose with nose pointing toward magnetic north. Using equation for Coefficient C, determine what compass should read when compensated. Adjust N-S compensating screw using a nonmagnetic screwdriver until compass indicates compensated value.
- Turn helicopter on compass rose with nose pointing toward east. Using equation for Coefficient B, determine what compass should read when compensated. Adjust E-W compensating screw using a nonmagnetic screwdriver until compass indicates compensated value.
- Using equation for Coefficient A, determine total deviation. TOTAL MAXIMUM POSITIVE AND NEGATIVE DEVIATION AFTER COMPENSATION SHALL NOT EXCEED 5°. Replace compass if limit is exceeded.

1) Park helicopter on compass rose with nose pointing toward magnetic north (0°). Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 8°.

2) Turn helicopter on compass rose with nose pointing toward east (90°). Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 86°.

3) Turn helicopter on compass rose with nose pointing toward south (180°). Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 176°.

4) Turn helicopter on compass rose with nose pointing toward west (270°). Record compass reading on Compensating Swing Table ACFT COMP column. Example compass reading is 278°.

5) Subtract ACFT COMP value from ACTUAL HEAD (M) value for N, E, S, and W. Record result in DEVIATION column (ACTUAL HEAD (M) - ACFT COMP = DEVIATION).

6) Turn helicopter on compass rose with nose pointing toward magnetic north. Using equation for Coefficient C, determine what compass should read when compensated. Adjust N-S compensating screw using a nonmagnetic screwdriver until compass indicates compensated value.

7) Turn helicopter on compass rose with nose pointing toward east. Using equation for Coefficient B, determine what compass should read when compensated. Adjust E-W compensating screw using a nonmagnetic screwdriver until compass indicates compensated value.

8) Using equation for Coefficient A, determine total deviation. TOTAL MAXIMUM POSITIVE AND NEGATIVE DEVIATION AFTER COMPENSATION SHALL NOT EXCEED 5°. Replace compass if limit is exceeded.

a) PERFORMING COEFFICIENT A

Frame #2028 (PERFORMING COEFFICIENT A)

$$\text{Coefficient A} = \frac{\text{N DEV} + \text{E DEV} + \text{S DEV} + \text{W DEV}}{4}$$

$$\frac{\text{N DEV} \quad \text{E DEV} \quad \text{S DEV} \quad \text{W DEV}}{(+8) + (-4) + (-4) + (+8)}{4}$$

$$\frac{16 + (-8)}{4} = \frac{8}{4} = 2$$

Desired Headings:	Example: Compass Headings	Deviations:
North = 000°	North = 008°	N DEV = + 8
East = 90°	East = 86°	E DEV = - 4
South = 180°	South = 176°	S DEV = - 4
West = 270°	West = 278°	W DEV = + 8

1 When readings are taken and, if headings are shown greater than the headings desired, the number will be positive.

2 If the headings are shown less than the headings desired, the number will be negative.

3 Computations are completed by using the formula found on the compass compensation card for each coefficient.

4 The headings that are given are examples to be used in this formula to calculate for the coefficient.

b) PERFORMING COEFFICIENT C

Frame # 2029 (PERFORMING COEFFICIENT C)

$$\text{Coefficient C} = \frac{\text{N DEV} - \text{S DEV}}{2}$$

$$\frac{\text{N DEV} \quad \text{S DEV}}{\frac{(+8) \quad - \quad (-4)}{2}} = \frac{12}{2} = +6$$

Deviations:

N DEV = + 8

E DEV = - 4

S DEV = - 4

W DEV = + 8

1 When readings are taken and, if headings are shown greater than the headings desired, the number will be positive.

2 If the headings are shown less than the headings desired, the number will be negative.

3 Computations are completed by using the formula found on the compass compensation card for each coefficient.

4 The headings that are given are examples to be used in this formula to calculate for the coefficient.

c) PERFORMING COEFFICIENT B

Frame #2030 (PERFORMING COEFFICIENT B)

$$\text{Coefficient B} = \frac{\text{E DEV} - \text{W DEV}}{2}$$

$$\frac{\text{E DEV} \quad \text{W DEV}}{\frac{(-4) \quad - \quad (+8)}{2}} = \frac{-12}{2} = -6$$

Deviations:

N DEV = + 8

E DEV = - 4

S DEV = - 4

W DEV = + 8

1 When readings are taken and, if headings are shown greater than the headings desired, the number will be positive.

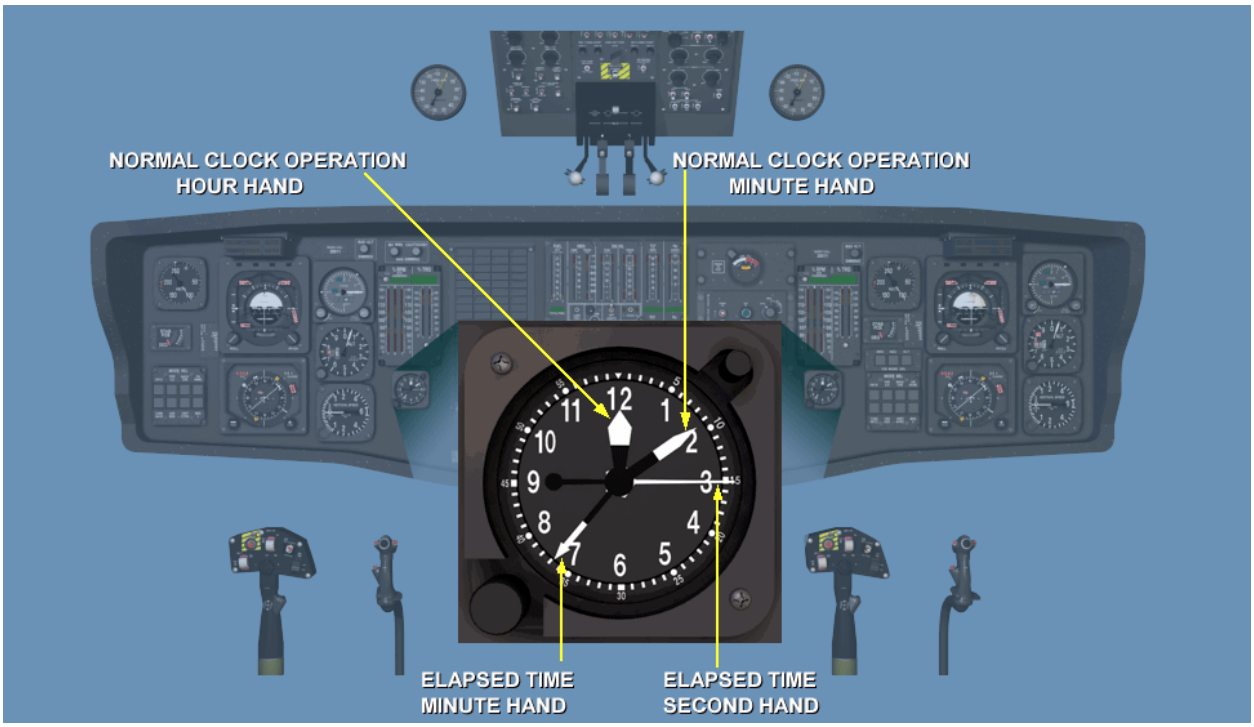
2 If the headings are shown less than the headings desired, the number will be negative.

3 Computations are completed by using the formula found on the compass compensation card for each coefficient.

4 The headings that are given are examples to be used in this formula to calculate for the coefficient.

c. AIRCRAFT CLOCK

Frame #2035 (AIRCRAFT CLOCK)



(1) On some aircraft an 8-day, 24-hour clock is installed on each side of the instrument panel.

(2) The elapsed time knob is on the upper right corner of the clock and works like a stop watch.

(3) The clock is wound and set with a knob on the lower left corner.

Frame #2036 AIRCRAFT CLOCK)

(4) On some aircraft a digital clock is installed on each side of the instrument panel.

(5) The digital clock has six-digit liquid crystal display, twenty-four hour numerals and sweep second indicator.

(6) The sweep second indicator operates in clock or elapsed mode.

(7) The clock contains a replaceable battery that allows continuous timekeeping with helicopter power turned off.

d. FREE AIR TEMPERATURE (FAT) GAGE

Frame #2040 (FREE AIR TEMPERATURE (FAT) GAGE)

(1) Two free-air thermometers / outside air temperature (FAT/OAT) are installed, one in the left upper window and one in the right upper window of the cockpit.

(2) The thermometer is a self-indicating bimetallic instrument that displays the free-air temperature.

(3) The thermometer dial is marked from -70° to 40 °C in 2° units.

(4) The 10° markings are indicated numerals.

(5) To avoid parallax, the pointer is mounted close to the dial.

Check on Learning

1. Which is not one of the steps in the testing/troubleshooting of the pitot-static system?

2. When does a standby compass compensation need to be completed?

3. What is not a reason for a compass replacement?

SECTION IV. -SUMMARY

1. REVIEW/SUMMARIZE:

You have completed the components and miscellaneous instruments of the Navigational and Communication system lesson for the UH-60 helicopter.

Key points to remember are:

- The pitot-static system provides impact and static pressure to operate the pilot and copilot altimeter, airspeed, vertical speed indicator as well as the airspeed and the air data transducers.
- The compass compensation is completed whenever there is an engine change, modification or change to the electrical system or major structural changes, compass is suspected of being in error, flux valve loose or removed or replaced, and every 12 months.
- The compass replacement criteria are clouded or discolored liquid, illegible card readings, failure of card to rotate freely, cracked bowl, broken frame or broken lugs, erratic action, failure of the compass to respond after compensating, lubber line loose or missing, air is visible in the bowl, and if the total deviation if the eight headings exceed 8 degrees.
- The different compass compensation methods are master sighting compass method, INS method, in-flight method, and compass rose method.
- The digital clock has a 6-digit liquid crystal, 24-hour numerals and sweep sound indicator. The digital clock contains a replaceable battery that allows continuous time keeping with the helicopter turned off.
- The free-air thermometer is a self-indicating bimetallic instrument that displays the free-air temperature.

C. ENABLING LEARNING OBJECTIVE ELO No.3

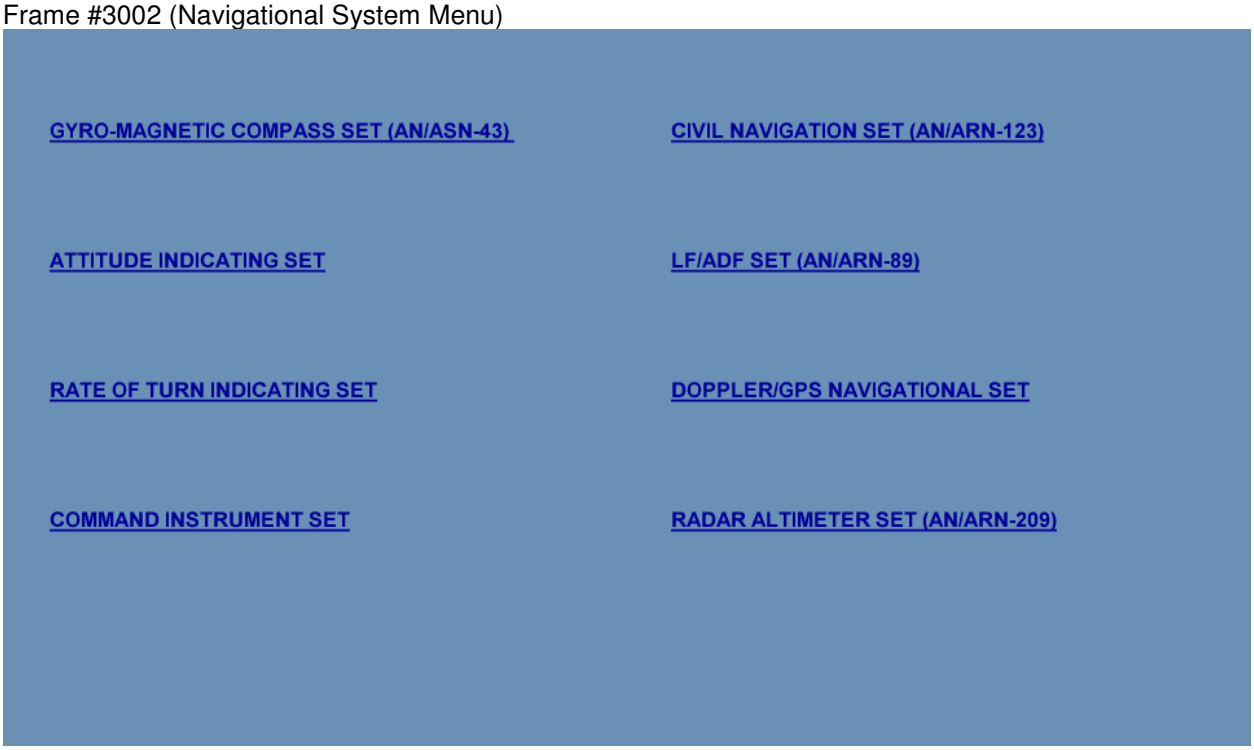
ACTION: List the components of the Navigational System of the UH-60.

CONDITION: Given TM 11-1520-237-23-1.

STANDARD: IAW TM 11-1520-237-23-1.

a. Navigational System Menu

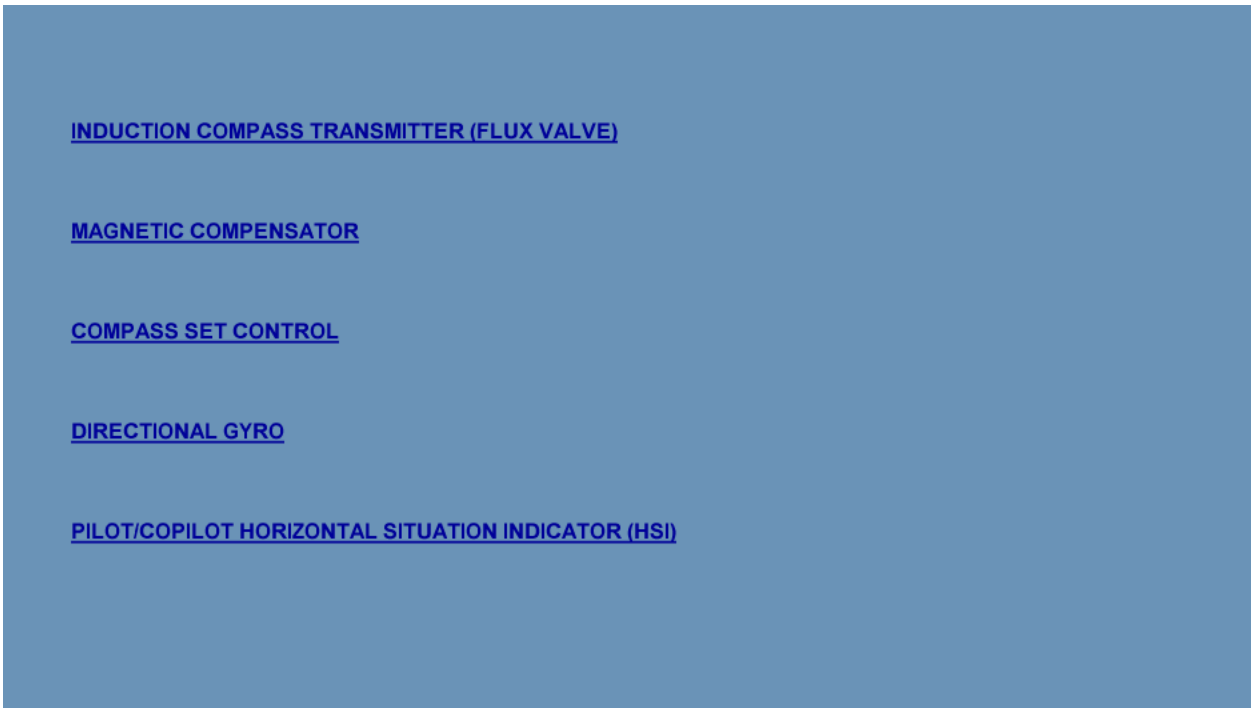
Frame #3002 (Navigational System Menu)



(1) The navigation system consists of the LF/ADF set, Gyro-Magnetic Compass set, Attitude Indicating set, Civil Navigation set, Command Instrument Set, Doppler/GPS, Radar Altimeter set, Rate of Turn Indicating set.

(a) Gyro-Magnetic Compass Set (AN/ASN-43)

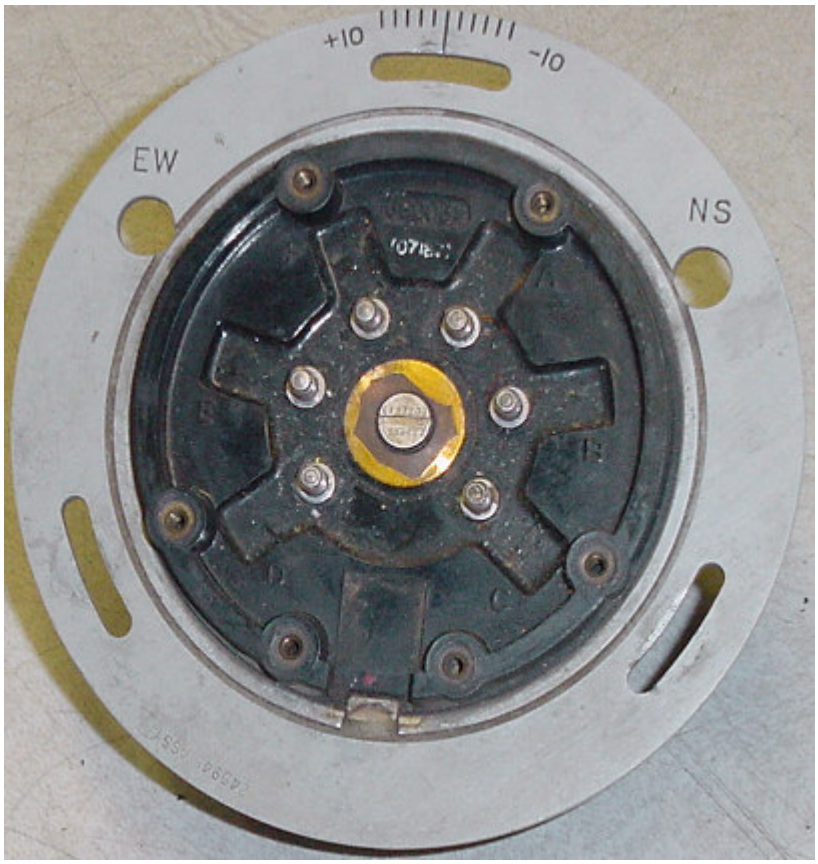
Frame #3005 (Gyro-Magnetic Compass Set (AN/ASN-43))



1) The Gyro-magnetic Compass (AN/ASN-43) Set provides accurate heading information that is either slaved to the earth's magnetic field when operating in the SLAVED mode or referenced to a free directional gyro heading when operating in the FREE mode.

a) Induction Compass Transmitter (Flux Valve)

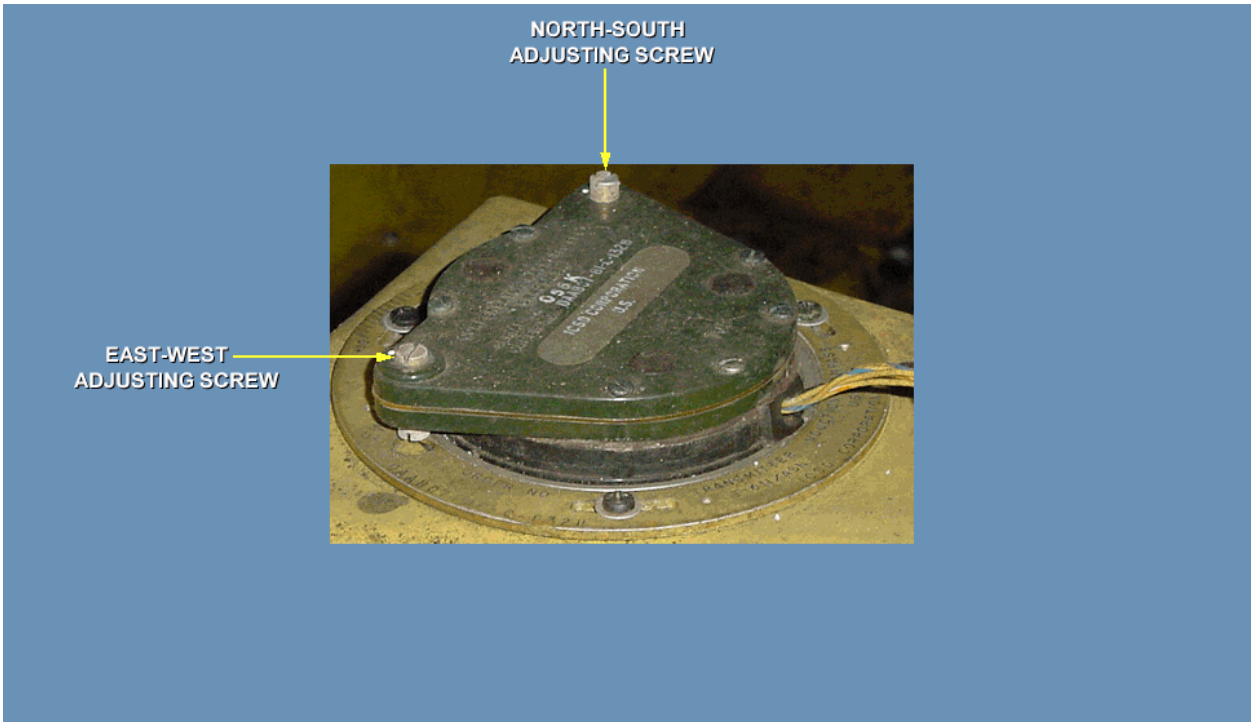
Frame #3010 (Induction Compass Transmitter (Flux Valve)



1 The flux valve is located on the right side of the tail boom and it senses the direction of the earth's magnetic field and generates a reference heading signal.

b) Magnetic Compensator

Frame #3020 (Magnetic Compensator)



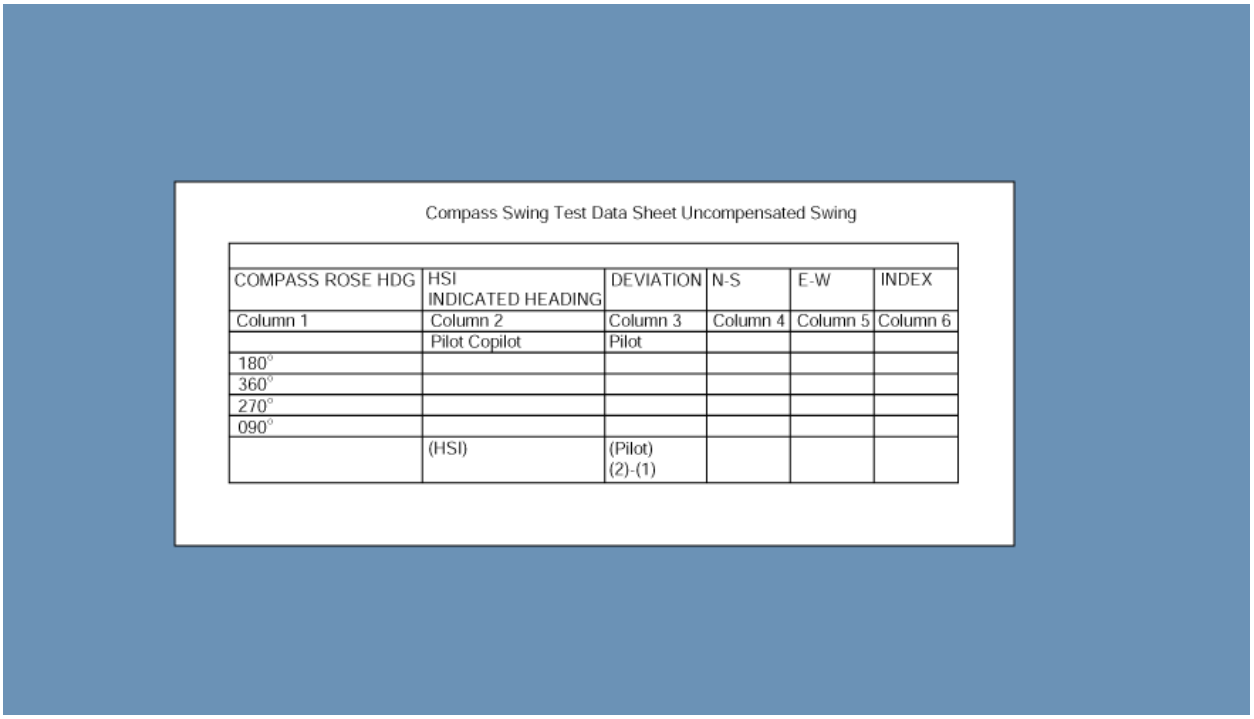
1 The magnetic compensator is located on the right side of the tail boom on top of the flux valve.

2 Deviations that may be caused by unwanted magnetic fields is compensated by the magnetic compensator.

3 The adjustment screws are used to compensate for deviations during a compensator calibration.

c) Compass Swing Test Data Sheet Uncompensated Swing

Frame #3055 (Compass Swing Test Data Sheet Uncompensated Swing)



1 The Compass Swing Test Data Sheet Uncompensated Swing card is used as a worksheet for readings from the HSI, to allow for computations for adjustments during the Transmitter Index Error correction portion of the compass compensation of the Gyro Magnetic Set.

d) Compass Compensation

Frame #3060 (Compass Compensation)

1 Conditions

Frame #3063 (Conditions)

- Swing compass only when aircraft is in its flight configuration.
- Do test on surveyed compass rose.
- Keep compass rose free of equipment.
- Store all aircraft flight equipment in its normal location.
- When doing this procedure, do not carry magnetic materials within 5 feet of transmitter (no watches, badges, headsets, flashlights, metal tools keys, etc.). Use only non-magnetic screwdriver to adjust compensator.
- Position aircraft on compass rose, wheel secured on turntable (if using a tug).
- May use a tug to move aircraft. Rotors do not need to be turning.
- If tug is used, it must be moved away, with towbar, at least 100 feet.

a Swing compass only when the aircraft is in its flight configuration.

b Do test on surveyed compass rose.

c Keep compass rose free of equipment.

d Store all aircraft flight equipment in its normal location.

e When doing this procedure, do not carry magnetic materials within 5 feet of transmitter (no watches, badges, headsets, flashlights, metal tools keys, etc.). Use only a non-magnetic screwdriver to adjust compensator.

f Position the aircraft on compass rose, wheel secured on turntable (if using a tug).

g You may use a tug to move aircraft. The rotors do not need to be turning.

h If a tug is used, it must be moved away, with a towbar, at least 100 feet.

2 Setup

Frame #3066 (Setup)

- Make sure all circuit breakers are in.
- Remove all access panels at transmitter and compensator.
- Set compass control panel SLAVED/FREE switch to SLAVED.
- Line up transmitter North/South and East/West adjusting screw with "dots" on compensator.
- Start aircraft APU and place APU generator switch on.
- Turn the following systems on: All communications and navigation sets, cabin heater blower, AFCS, anticollision lights, cabin console lights, and instrument lights.

a Make sure all circuit breakers are in.

b Remove all access panels at transmitter and compensator.

c Set compass control panel SLAVED/FREE switch to SLAVED.

d Line up transmitter North/South and East/West adjusting screw with "dots" on compensator.

e Start aircraft APU and place APU generator switch on.

f Turn the following systems on: All communications and navigation sets, cabin heater blower, AFCS, anticollision lights, cabin console lights, and instrument lights.

3 North/South Correction

Frame #3069 (North/South Correction)

- Position aircraft to compass rose SOUTH heading.
- Synchronize set with PUSH TO SET knob until annunciator is centered. Record pilot and copilot HSI compass card headings in column 2 of the Compass Swing Test Data Sheet Uncompensated Swing.
- Determine compass deviation by subtracting indicating heading from compass rose heading. Use pilot HSI for all calculations. Record deviation in column 3 of the Compass Swing Test Data Sheet Uncompensated Swing card. (A deviation is positive (+) if the compass rose heading is greater the HSI heading, and negative (-) if less than the HSI heading.)
- Position aircraft to compass rose NORTH heading.
- Synchronize set with PUSH TO SET knob until annunciator pointer is centered. Record Pilot and Copilot HSI compass card headings in column 2.
- Determine compass deviation by subtracting indicated heading from compass rose heading. Use Pilot HSI for all calculations. Record deviation in column 3.
- Determine the compass North/South correction: North/South Correction = $\frac{\text{N DEV - S DEV}}{2}$
- Determine North Corrected Heading: North Corrected Heading = North Indicated Heading + North/South Correction
- With aircraft on the compass rose heading do North/South adjustments.
- Turn PUSH TO SET knob on compass control panel until pilot HSI compass card indicate North Corrected Heading. Record this heading in column 4.
- Turn compensator N-S screw until compass control panel annunciator pointer is centered.

a Position aircraft to compass rose SOUTH heading.

b Synchronize set with PUSH TO SET knob until annunciator is centered. Record pilot and copilot HSI compass card headings in column 2 of the Compass Swing Test Data Sheet Uncompensated Swing.

c Determine compass deviation by subtracting indicating heading from compass rose heading. Use pilot HSI for all calculations. Record deviation in column 3 of the Compass Swing Test Data Sheet Uncompensated Swing card. (A deviation is positive (+) if the compass rose heading is greater the HSI heading, and negative (-) if less than the HSI heading.)

d Position aircraft to compass rose NORTH heading.

e Synchronize set with PUSH TO SET knob until annunciator pointer is centered. Record Pilot and Copilot HSI compass card headings in column 2.

f Determine compass deviation by subtracting indicated heading from compass rose heading. Use Pilot HSI for all calculations. Record deviation in column 3.

g Determine the compass North/South correction:
North/South Correction = $\frac{\text{N DEV - S DEV}}{2}$

h Determine North Corrected Heading:
North Corrected Heading = North Indicated Heading + North/South Correction

i With aircraft on the compass rose heading, do North/South adjustments.

j Turn PUSH TO SET knob, on compass control panel, until pilot HSI compass card indicate North Corrected Heading. Record this heading in column 4.

k Turn compensator N-S screw until compass control panel annunciator pointer is centered.

4 East/West Correction

Frame #3072 (East/West Correction)

- Position aircraft on compass rose WEST heading.
- Synchronize set by turning compass control panel PUSH TO TEST knob until annunciator pointer is centered. Record indicated HSI compass card heading in column 2 of the Compass Swing Test Data Sheet Uncompensated card.
- Determine compass deviation by subtracting indicated heading from compass rose heading. Use Pilot HSI for calculations. Record deviation in column 3.
- Position aircraft to compass rose EAST heading.
- Synchronize set by turning compass control panel PUSH TO SET knob until annunciator pointer is centered. Record indicated HSI compass card heading in column 2.
- Determine compass deviation by subtracting indicated heading from compass rose heading. Use pilot HSI for calculations. Record deviation in column 3.
- Determine East / West Correction: East / West Correction = $\frac{\text{EAST /DEV - WEST DEV}}{2}$
- Determine East Corrected Heading:
- East Corrected Heading = EAST INDICATED HEADING + EAST/WEST CORRECTION
- With aircraft on the EAST compass heading, do the East/West adjustments.
- Turn PUSH TO SET knob on compass control panel until pilot HSI compass card indicates East Corrected Heading.
- Turn compensator E-W screw until compass control panel annunciator pointer is centered.

a Position aircraft on compass rose WEST heading.

b Synchronize set by turning compass control panel PUSH TO TEST knob until annunciator pointer is centered. Record indicated HSI compass card heading in column 2 of the Compass Swing Test Data Sheet Uncompensated card.

c Determine compass deviation by subtracting indicated heading from compass rose heading. Use Pilot HSI for calculations. Record deviation in column 3.

d Position aircraft to compass rose EAST heading.

e Synchronize set by turning compass control panel PUSH TO SET knob until annunciator pointer is centered. Record indicated HSI compass card heading in column 2.

f Determine compass deviation by subtracting indicated heading from compass rose heading. Use pilot HSI for calculations. Record deviation in column 3.

g Determine East / West Correction:
East / West Correction =
$$\frac{\text{EAST /DEV - WEST DEV}}{2}$$

h Determine East Corrected Heading:
East Corrected Heading =
EAST INDICATED HEADING + EAST/WEST CORRECTION

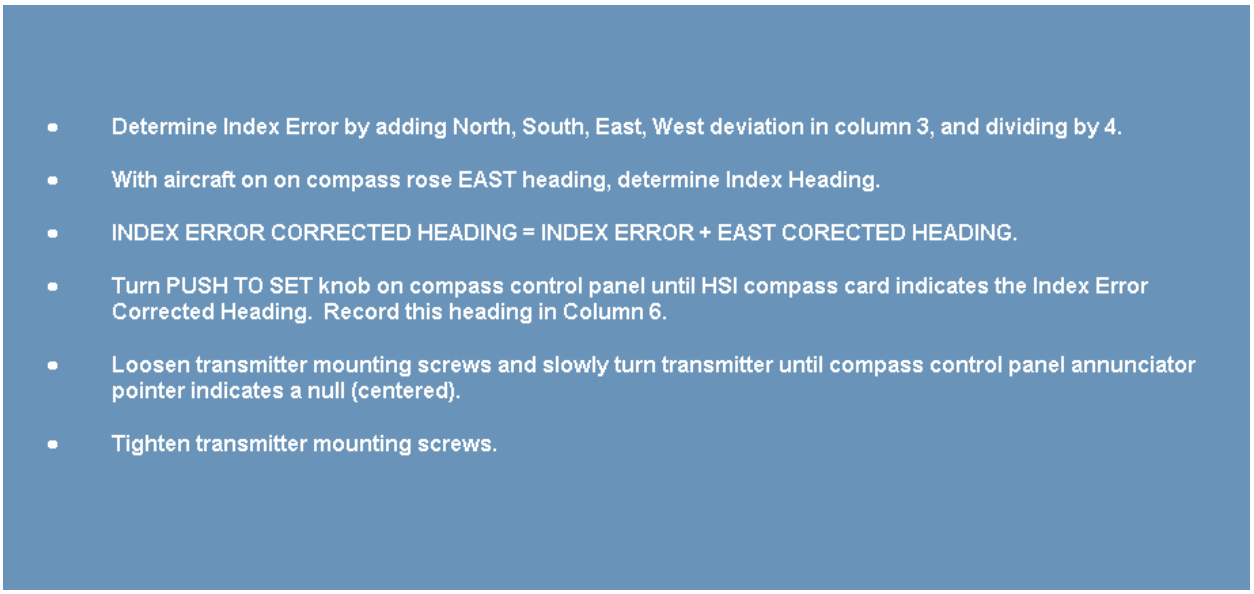
i With aircraft on the EAST compass heading, do the East/West adjustments.

j Turn PUSH TO SET knob on compass control panel until pilot HSI compass card indicates East Corrected Heading.

k Turn compensator E-W screw until compass control panel annunciator pointer is centered.

5 Transmitter Index Error Correction

Frame #3073 (Transmitter Index Error Correction)



a Determine Index Error by adding North, South, East, West deviation in column 3, and dividing by 4.

b With aircraft on compass rose EAST heading, determine Index Heading.

c INDEX ERROR CORRECTED HEADING = INDEX ERROR + EAST CORECTED HEADING.

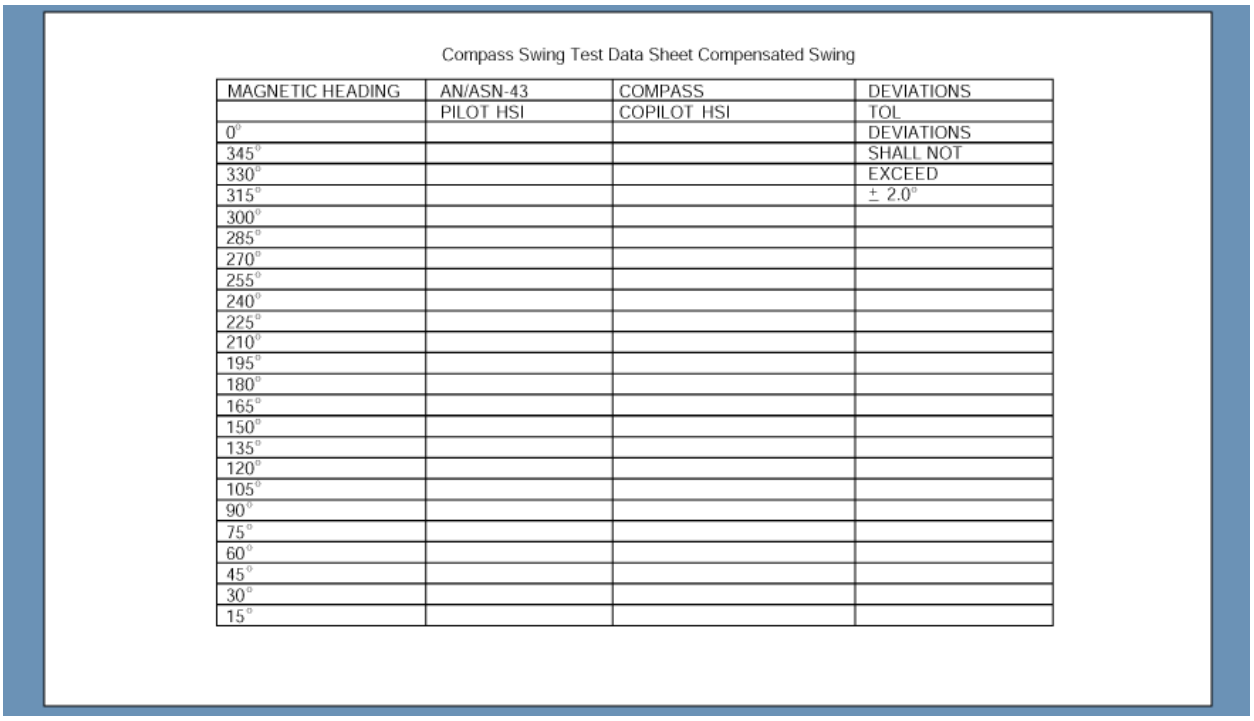
d Turn PUSH TO SET knob on compass control panel until HSI compass card indicates the Index Error

e Loosen transmitter mounting screws and slowly turn transmitter until compass control panel annunciator pointer indicates a null (centered).

f Tighten transmitter mounting screws.

6 Compensated Compass Swing

Frame #3078 (Compensated Compass Swing)



Compass Swing Test Data Sheet Compensated Swing

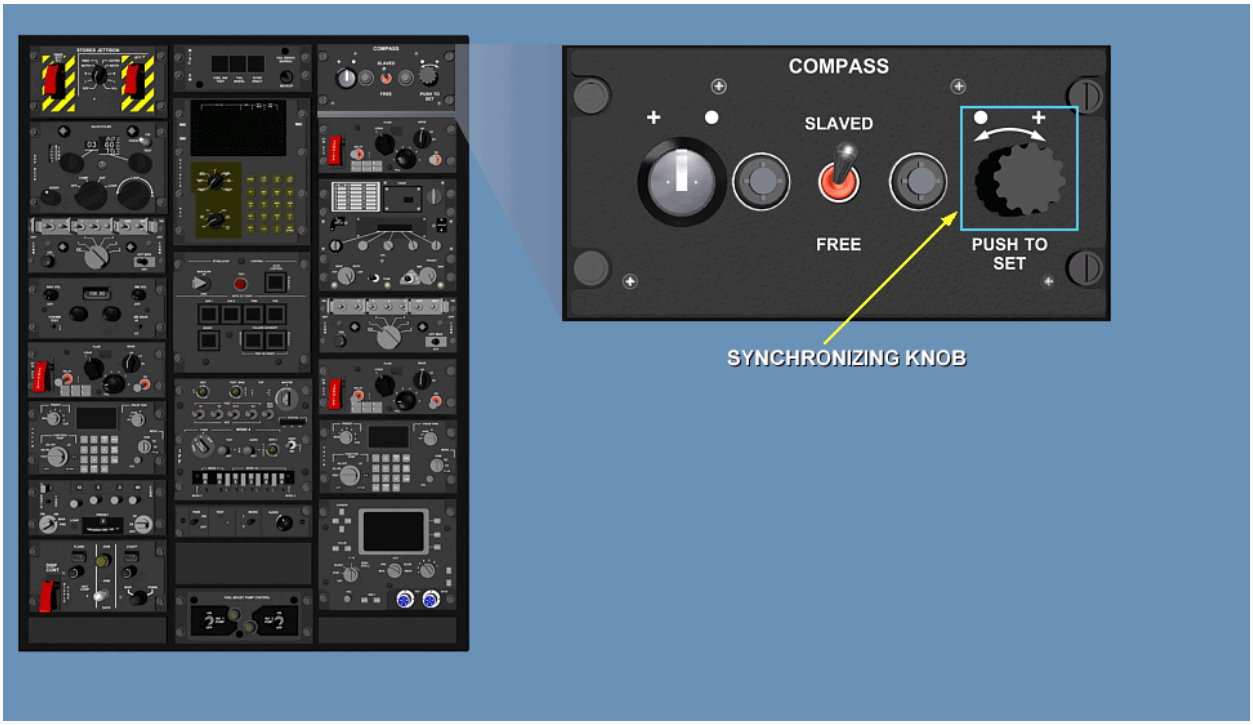
MAGNETIC HEADING	AN/ASN-43 PILOT HSI	COMPASS COPILOT HSI	DEVIATIONS TOL
0°			DEVIATIONS
345°			SHALL NOT
330°			EXCEED
315°			± 2.0°
300°			
285°			
270°			
255°			
240°			
225°			
210°			
195°			
180°			
165°			
150°			
135°			
120°			
105°			
90°			
75°			
60°			
45°			
30°			
15°			

a Position aircraft to each heading on Compass Swing Test Data Sheet Compensated Swing and record deviation at each heading for each HSI.

b Deviation at any heading shall not be over (+ or -) 2 degrees.

e) Compass Set Control

Frame #3030 (Compass Set Control)

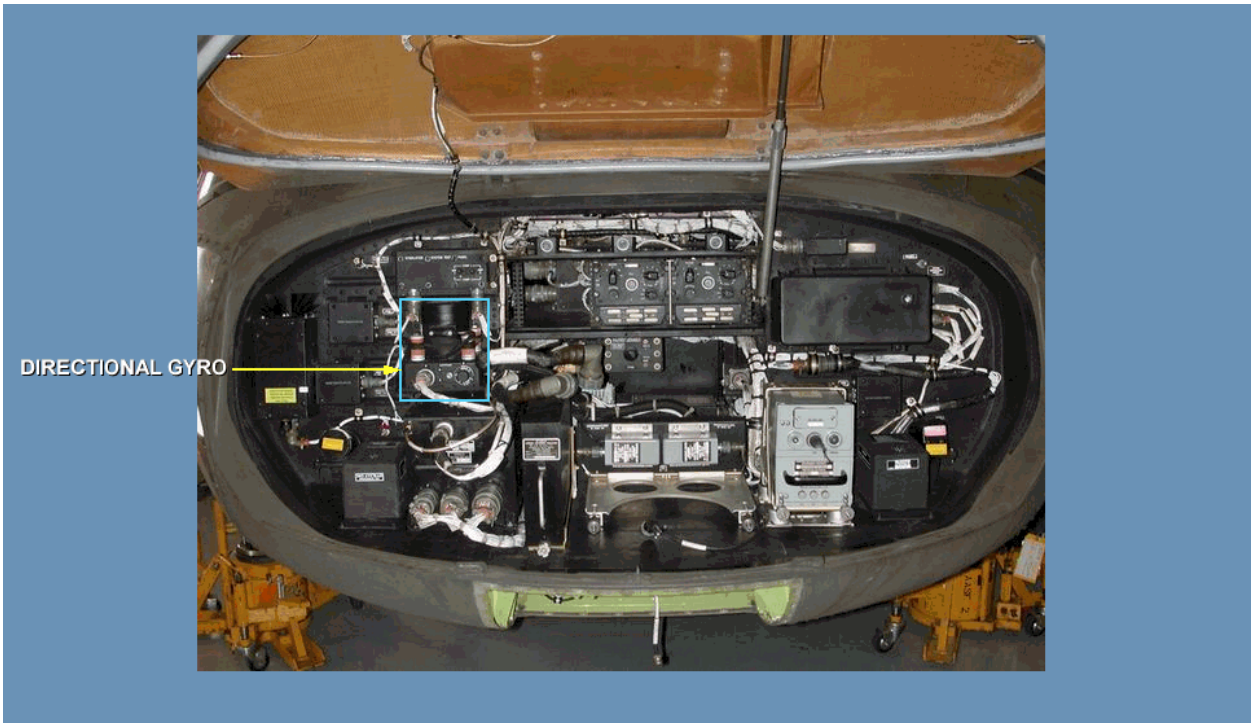


1 Compass Set Control panel is required to synchronize (electrically and mechanically align) the AN/ASN-43 to the correct magnetic heading when used in the SLAVED mode of operation.

2 The synchronizing knob on the control panel may be used as a set heading knob for operation in the FREE mode.

f) Directional Gyro

Frame #3040 (Directional Gyro)



1 The Gyromagnetic Compass (AN/ASN-43) Set provides accurate heading information that is either slaved to the earth's magnetic field when operating in the SLAVED mode, or referenced to a free directional gyro heading when operating in the FREE mode.

2 The heading information is applied to the pilot and copilot Horizontal Situation Indicator (HSI) for a visual indication of helicopter headings.

g) Pilot/Copilot Horizontal Situation Indicator (HSI)

Frame #3050 (Pilot/Copilot Horizontal Situation Indicator (HSI)

1 Two HSIs are installed on the instrument panel, one in front of each pilot.

2 The heading information is applied to the pilot and copilot HSI for a visual indication of helicopter headings.

3 With the SLAVED/FREE switch set to SLAVED, the directional gyro is slaved to the earth magnetic field to provide accurate heading information to both HSIs.

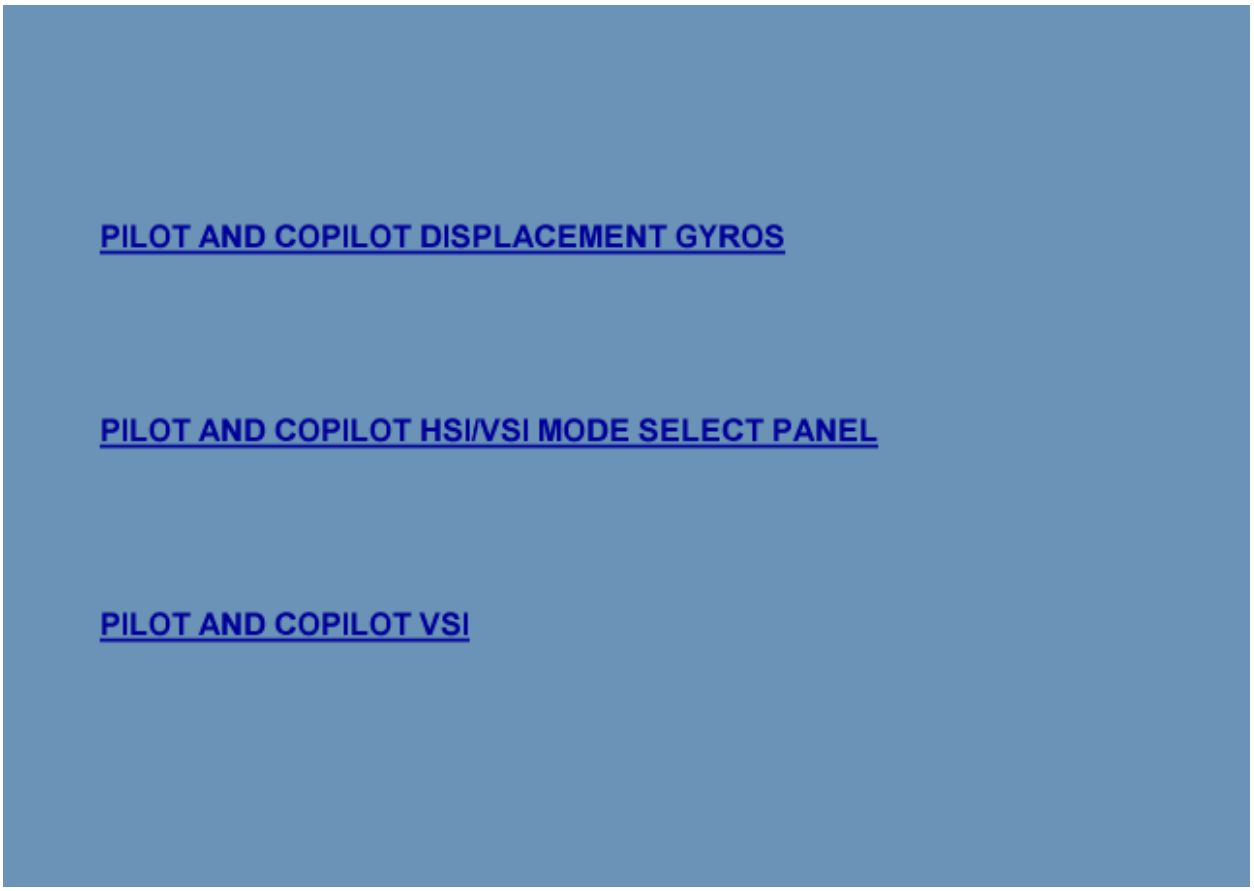
4 With the SLAVED/FREE switch placed to FREE, the Set slaving circuits are de-energized.

5 Free drift of the directional gyro outer gimbal, as a result of changes in helicopter heading, creates a heading synchro signal as in the SLAVED mode.

6 This signal then applies a heading differential signal to both HSIs to reposition the compass cards to the new heading.

(b) Attitude Indicating Set

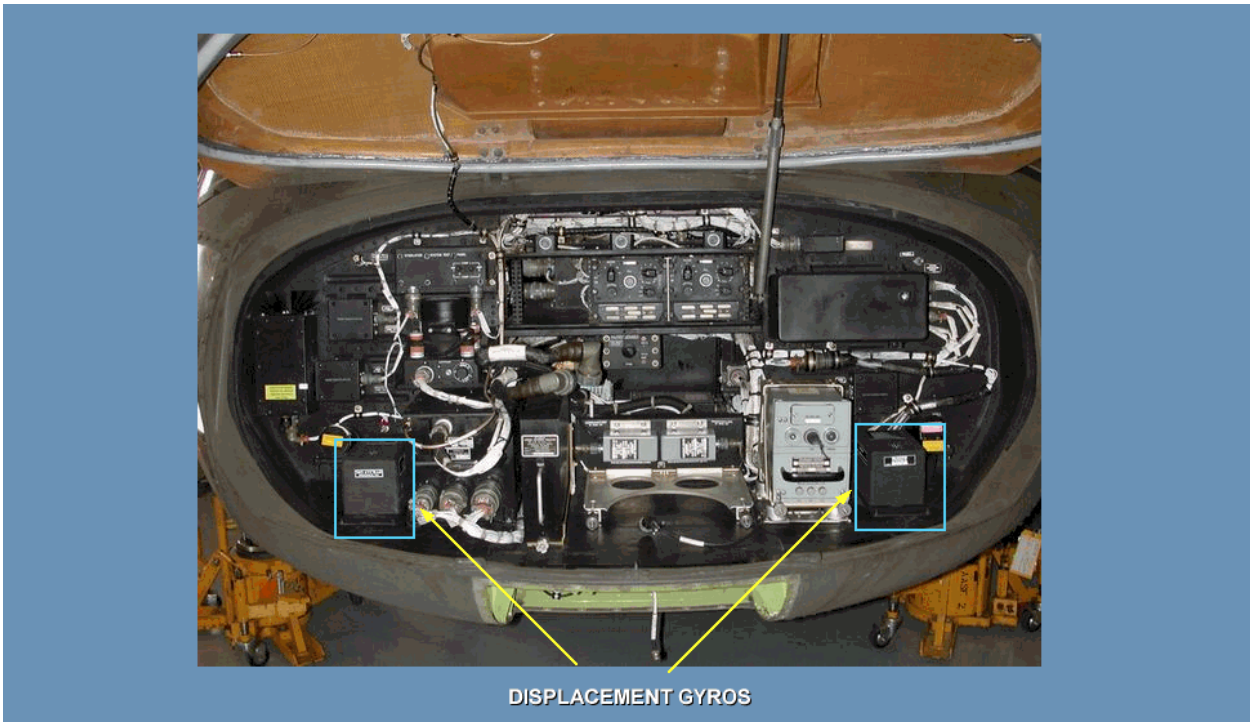
Frame #3080 (Attitude Indicating Set)



1) The Attitude Indicating Set visually displays the helicopter pitch and roll attitudes.

a) Pilot and Copilot Displacement Gyros

Frame #3085 (Pilot and Copilot Displacement Gyros)



1 The helicopter attitude is sensed by both gyros that supply pitch and roll attitude signals to both HSI/VSI mode select panels.

b) Pilot and Copilot HSI/VSI Mode Select Panel

Frame #3090 (Pilot and Copilot HSI/VSI Mode Select Panel)

1 Two HSI/VSI mode select panels are installed on the instrument panel, one for pilot and copilot.

2 Each HSI/VSI mode select panel has two rows of four selector switches.

3 The top row of switches selects a particular navigation function for display on the VSI and HSI.

4 The bottom row permits each pilot to transfer VSI gyro and turn rate inputs, select HSI CRS and HEADING outputs, and select HSI No. 2 pointer input.

5 Each panel contains a lighted push-on-push-off switch labeled VERT GYRO.

6 Pushing the VERT GYRO switch changes its position from NORM to ALTR, or ALTR to NORM.

7 The VERT GYRO switches allow the pilot and copilot to select the pilot gyro output or the copilot gyro output to drive the attitude indicators on each VSI.

c) Pilot and Copilot VSI

Frame #3095 (Pilot and Copilot VSI)

1 The Vertical Situation Indicator (VSI) displays pitch and roll attitude, turn rate, slip and skid, and Command Instrument Set (CIS) steering commands.

2 Helicopter pitch and roll attitudes are visually displayed on both VSI.

3 The VSI dial face contains a fixed bar representing the helicopter, a moving sphere with a distinct white horizon line dividing the two colors, white above and black below, a fixed bank angle scale, and a bank index on the moving sphere.

4 The relative position of the fixed bar (helicopter) and the horizon line indicates the helicopter attitude referenced to the earth horizon.

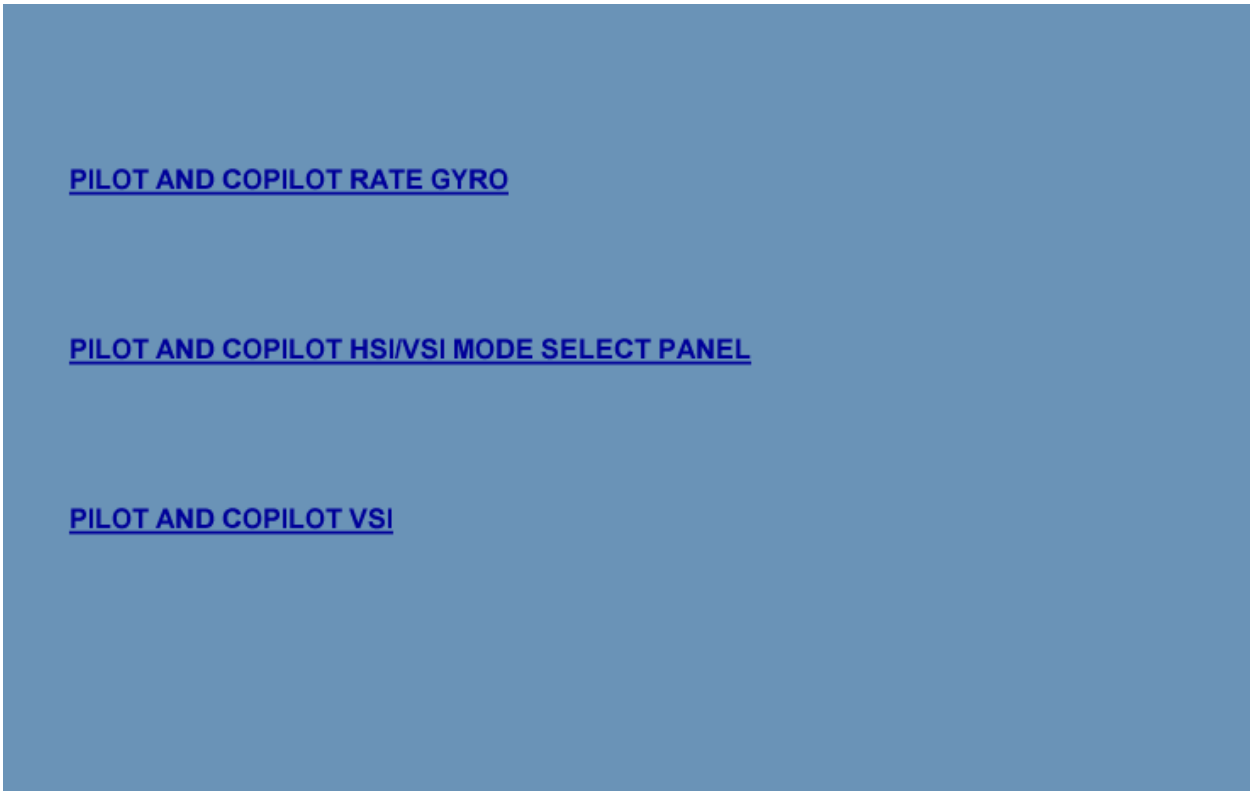
5 Pitch and roll displacement signals from the gyro cause the indicator sphere to move.

6 The bar above the horizon line indicates climb, and the bar below the horizon line indicates dive.

7 The right or left movement of the bank index indicates the direction of roll. PITCH and ROLL trim knobs (VSI) permits adjustment from the zero index.

(c) Rate of Turn Indicating Set

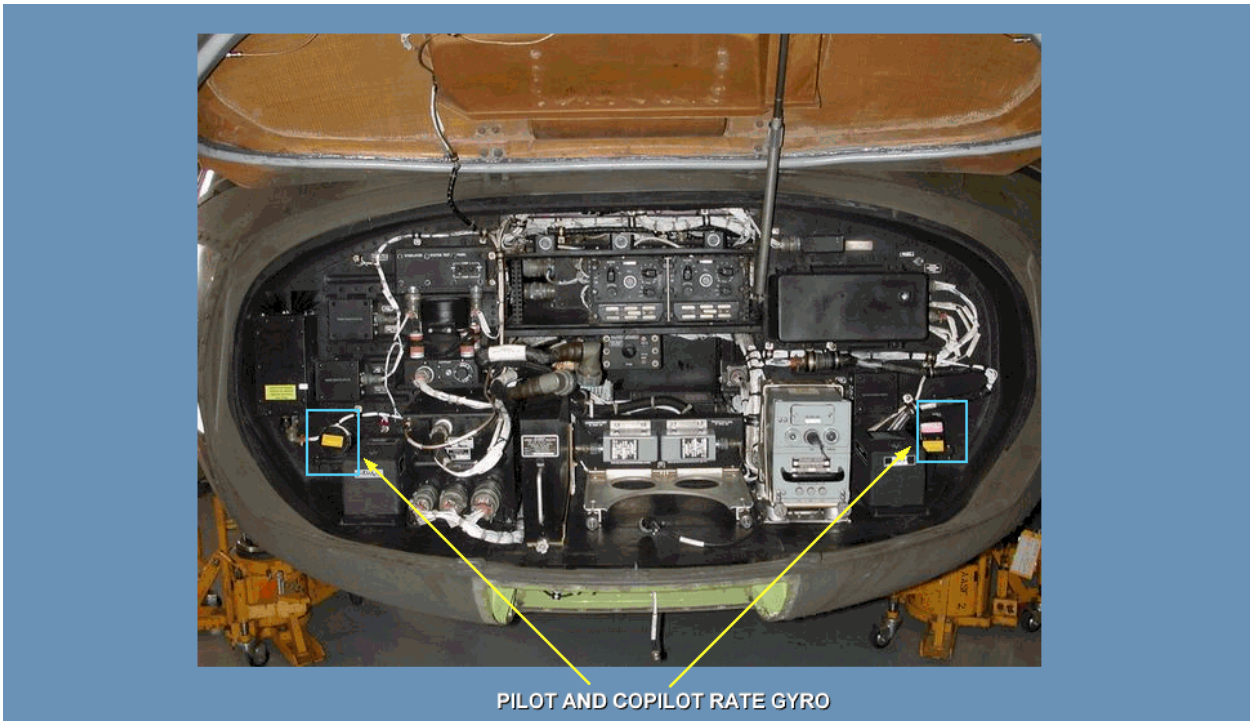
Frame #3100 (Rate of Turn Indicating Set)



1) The Rate of Turn Indicating Set visually displays the helicopter slip/skid and turn rate.

a) Pilot and Copilot Rate Gyro

Frame #3110 (Pilot and Copilot Rate Gyro)



1 The Rate of Turn Indicating Set contains two rate gyros (gyro), one each for the pilot and copilot, that provide turn rate information for the VSI.

b) Pilot and Copilot Mode Select Panel

Frame #3120 (Pilot and Copilot Mode Select Panel)

1 Each HSI/VSI mode select panel has two rows of four selector switches.

2 The top row of switches selects a particular navigation function for display on the VSI and HSI.

3 The bottom row permits each pilot to transfer VSI gyro and turn rate inputs, select HSI CRS and HDG outputs, and select HSI No. 2 pointer input.

4 Each HSI/VSI mode select panel contains a lighted push-on, push-off switch labeled TURN RATE.

5 Pushing the TURN RATE switch changes its position from NORM to ALTR, or ALTR to NORM.

6 The TURN RATE switches allow the pilot and copilot to select between the pilot rate gyro output or copilot rate gyro output to drive the rate-of-turn indicator on each VSI.

c) Pilot and Copilot VSI

Frame #3130 (Pilot and Copilot VSI)

1 Helicopter pitch and roll attitudes, referenced to a level attitude, are sensed by both rate gyros.

2 The rate gyros apply the pitch and roll attitude signals through the HSI/VSI mode select panels to the attitude indicator portion and the rate of turn portion of the VSI for visual display.

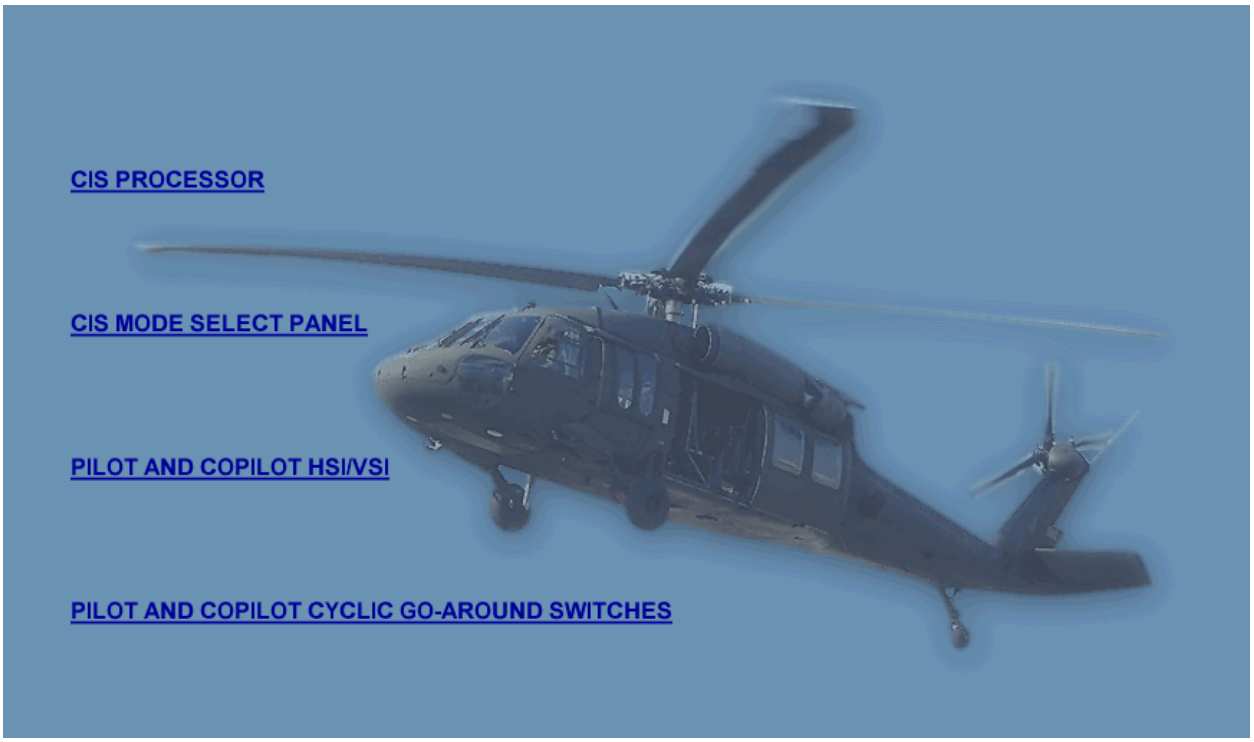
3 When the CMD flag is in view, the respective CIS command bars or pointers are biased out of view.

4 Similarly, the VSI NAV flag for navigation localizer inputs, the ATT flag for the attitude gyro, and the GS flag for ILS glide slope signals are displayed when power failure or unreliable operation occurs in the selected set.

5 The navigational signals include Heading, VOR, ILS, FM Homing, and Doppler.

(d) Command Instrument Set

Frame #3200 (Command Instrument Set)



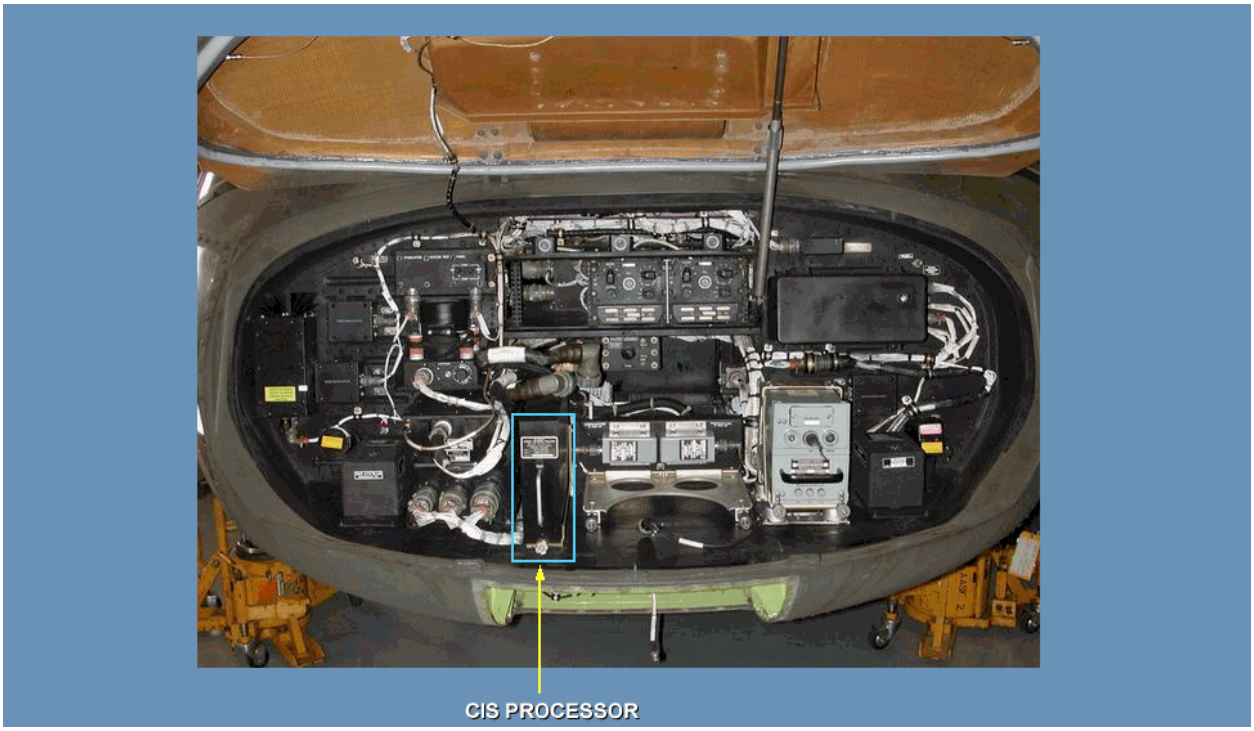
1) The Command Instrument Set (CIS) is an Integrated Navigation Set.

2) It is based on a central computer that processes signals from Navigation Sets, No. 1 VHF/FM Radio Set, and Flight Instruments System to produce visible steering commands for the pilot and copilot.

3) The steering commands allow the pilot to: fly a desired heading, reach a selected course, make an ILS landing, keep at a fixed altitude, and make a programmed deceleration and descent to a predetermined airspeed and altitude.

a) CIS Processor

Frame #3210 CIS Processor



1 The two types of Command Instrument Set (CIS) Processors are Analog and Digital.

2 The processor receives inputs from the AFCS, Barometric- altimeter, pilot vertical gyro, ASN-43, and radar altimeters, navigational inputs from the Civil Navigation Set and Doppler/GPS.

b) CIS Mode Select Panel

Frame #3220 (CIS Mode Select Panel)

1 When the CIS mode select panel NAV legend is on, the pilot's HSI/VSI mode select panel provides the selected navigation input (Doppler, VOR/ILS, or VHF/FM) to the CIS processor.

2 The NAV mode command outputs are normally provided to the pilot VSI only.

3 The copilot can display CIS commands on the VSI by selecting the same navigation mode on the HSI/VSI mode select panel.

4 When a different mode is selected, the command bars and pointers on the copilot VSI are biased out of view.

5 The heading mode processes the heading error and roll attitude signals to supply a limited cyclic roll command, which when followed, causes the helicopter to acquire and track the heading manually selected on either pilot's HSI.

6 The processed signal causes the VSI cyclic roll command bar to deflect in the direction of the required control response.

7 The processor heading mode is engaged by momentarily pressing the HDG switch on the mode select panel.

8 When the CIS mode select panel NAV legend is on, the pilot HSI/VSI mode select panel provides the selected navigation input (Doppler, VOR/ILS, or VHF/FM) to the CIS processor.

9 The NAV mode command outputs are normally provided to the pilot VSI only.

10 The copilot can display CIS commands on his VSI by selecting the same navigation mode on his HSI/VSI mode select panel.

11 The altitude hold mode processes barometric pressure signals from the Air Data Transducer in addition to the collective stick position signal.

12 When the ALT switch on the mode select panel is pressed, the processor provides collective command signals, which, when properly followed, causes the helicopter to maintain altitude to within (+ or -) 50 feet approach.

13 The altitude hold is manually engaged by pressing the ALT hold switch on the mode select panel.

14 The processor will cause the ALT ON legend to light whenever the altitude hold mode is engaged.

15 The altitude hold mode may be manually disengaged by pressing the ALT hold switch when the ON legend is on.

16 Altitude hold mode may be disengaged also by selecting any other mode which takes priority.

c) Pilot and Copilot HSI

Frame #3230 (Pilot and Copilot HSI)

1 The HSI displays heading, bearing, and course deviation information and provides selected course and heading information.

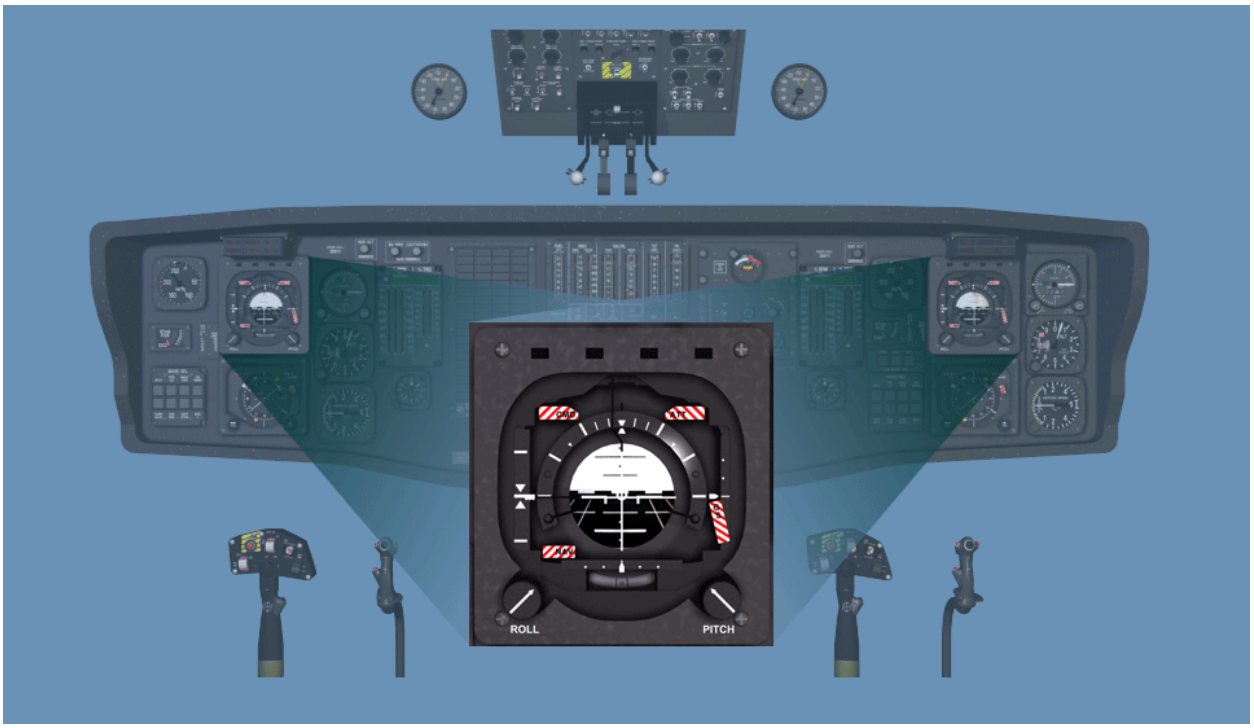
2 When the CMD flag is in view, the respective CIS command bars or pointers are biased out of view.

3 Similarly, the VSI NAV flag for navigation localizer inputs, the ATT flag for the attitude gyro, and the GS flag for ILS glide slope signals are displayed when power failure or unreliable operation occurs in the selected set.

4 The navigational signals include Heading, VOR, ILS, FM Homing, and Doppler.

d) Pilot and Copilot VSI

Frame #3231 (Pilot and Copilot VSI)



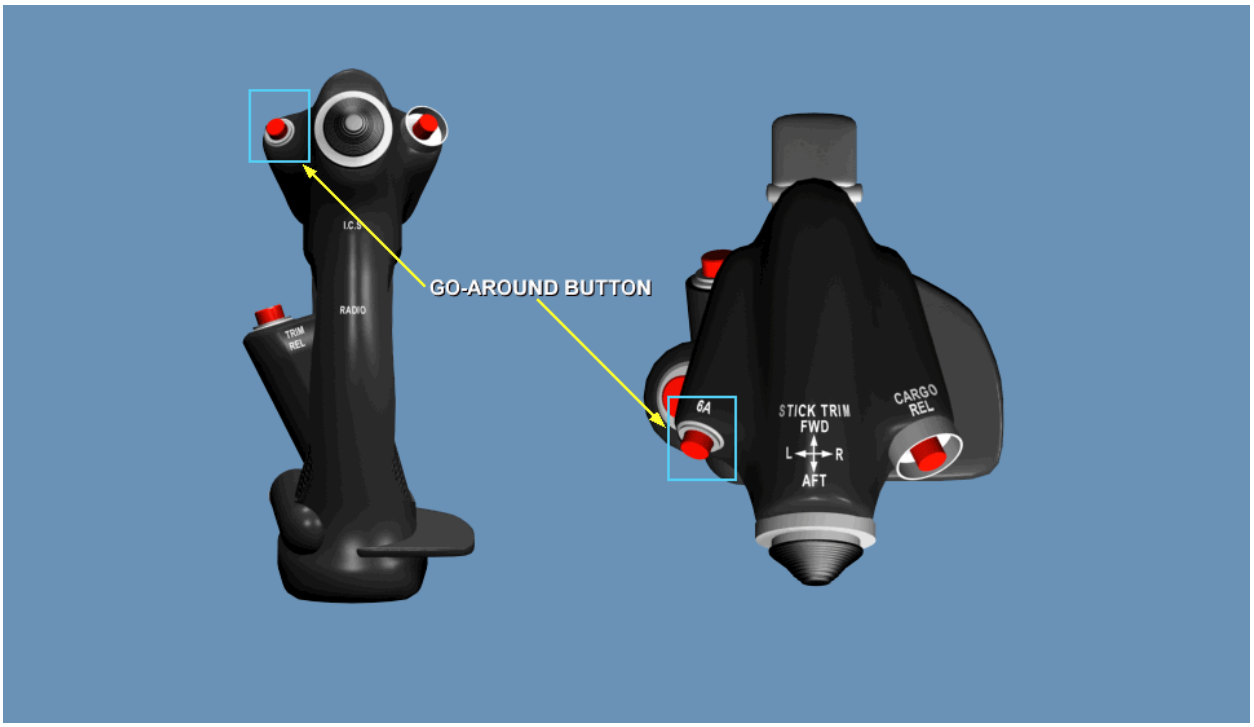
1 The VSI displays pitch and roll attitude, turn rate, slip and skid, and CIS steering commands.

2 When the CMD flag is in view, the respective CIS command bars, or pointers, are biased out of view. Similarly, the VSI NAV flag for navigation localizer inputs, the ATT flag for the attitude gyro, and the GS flag for ILS glide slope signals, are displayed when power failure or unreliable operation occurs in the selected Set.

3 The navigational signals include Heading, VOR, ILS, FM Homing, and Doppler.

e) Pilot and Copilot Cyclic Go-Around Buttons

Frame #3240 (Pilot and Copilot Cyclic Go-Around Buttons)



1 The go-around mode processes roll and pitch attitude, altitude rate, collective stick position, and airspeed inputs in addition to internally generated airspeed and vertical speed command signals to provide cyclic roll, cyclic pitch, and collective position indications.

2 The go-around mode will engage when either pilot presses the Go-Around (GA) button on his cyclic stick grip.

3 When the go-around mode is engaged, the processors immediately provides a collective position indication, which when followed, will result in a 500 (±) 50 fpm rate-of-climb at zero bank angle.

4 Five seconds after the GA button is pressed, the processor will provide a cyclic pitch bar command, which when properly followed, will result in an 80 KIAS for the climbout.

5 The go-around mode is disengaged by changing to any other mode on the pilot mode select panel or HSI/VSI mode select panel.

(e) Civil Navigation Set (AN/ARN-123)

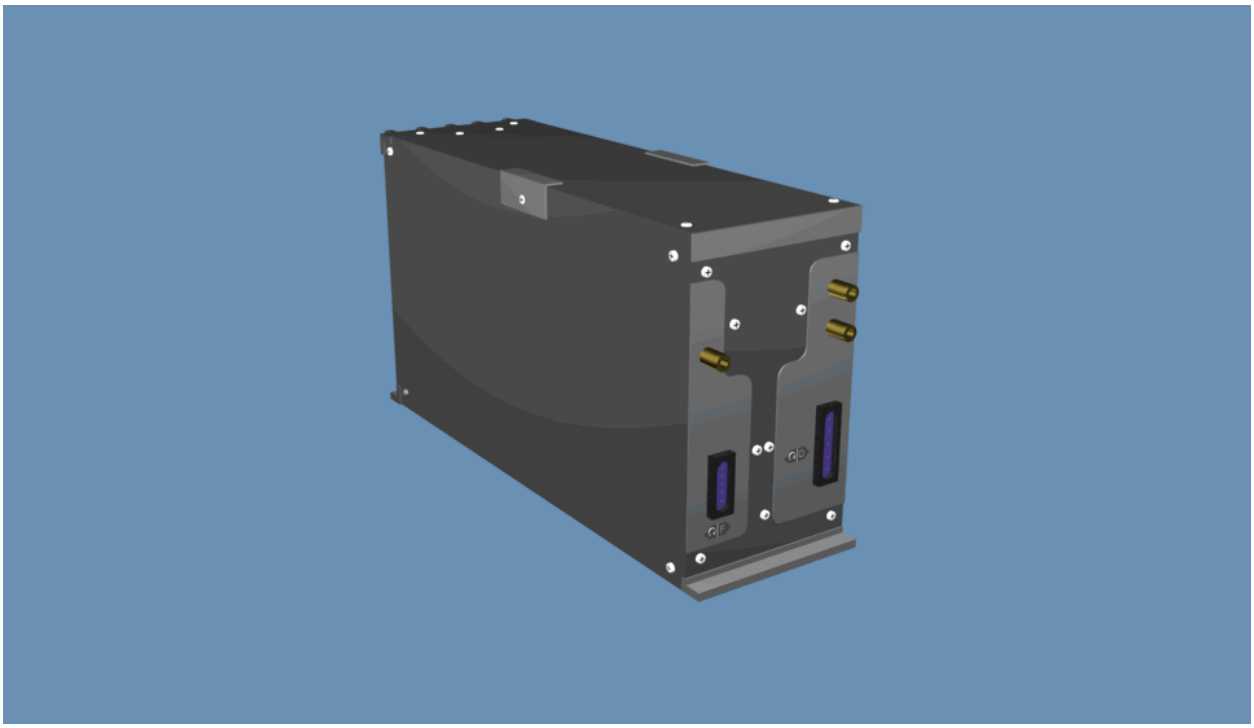
Frame #3300 (Civil Navigation Set (AN/AEN-123)

1) The Civil Navigation (AN/ARN-123) Set receives Very High Frequency (VHF) Omnirange (VOR), Localizer (LOC), Glide Slope (GS), and Marker Beacon (MB) signals to provide the pilot and copilot with visual and aural VOR/Instrument Landing Set (ILS) information.

2) Visual information permits manual VOR, automatic VOR bearing, LOC, GS, and MB indications. Aural information permits voice and code identification of VOR/LOC and MB signals.

a) Radio Receiver

Frame #3310 (Radio Receiver)



1 The radio receiver is located in the nose compartment.

2 The receiver contains three separate receiver sections which receive and process navigation signals within their respective frequency ranges.

3 The VOR/LOC receiver station receives 160 VOR channels and 40 LOC channels.

4 The GS receiver section receives 40 channels.

5 The use of both LOC and GS information makes up an instrument landing system (ILS).

6 The Marker Beacon receiver section is a 75 MHz fixed frequency receiver for tone-modulated Marker Beacon signals.

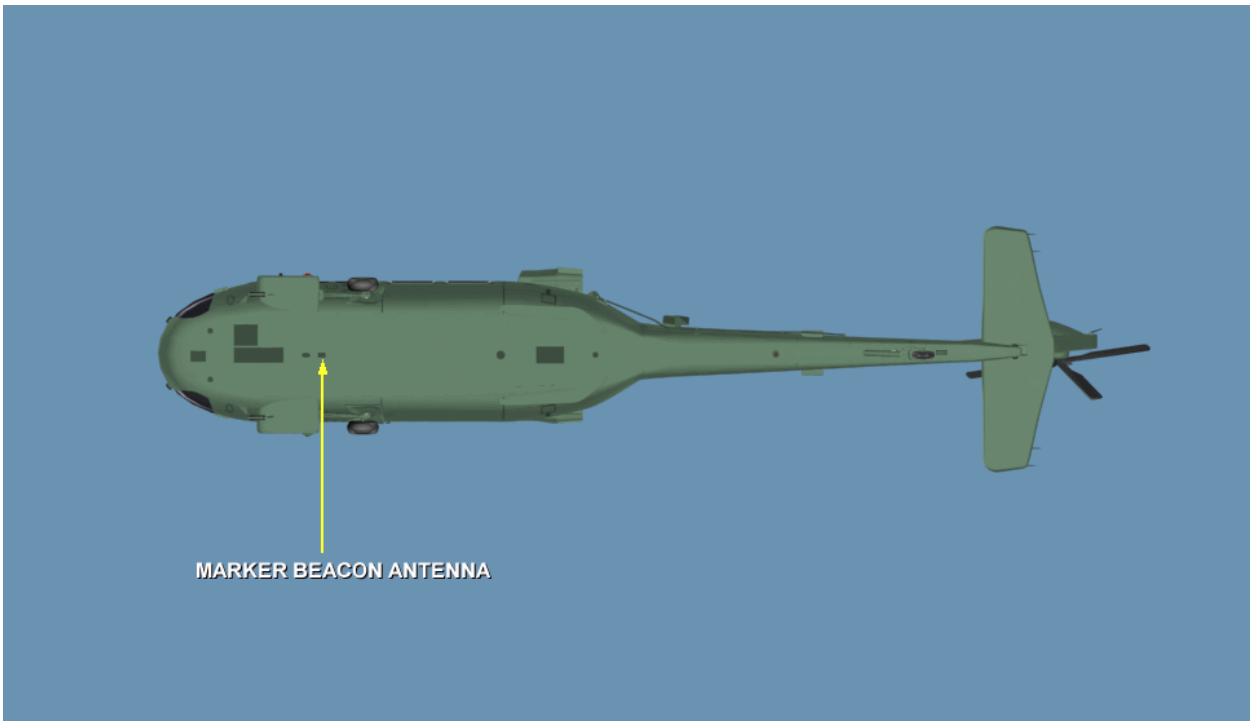
b) Receiver Control Unit

Frame #3330 (Receiver Control Unit)

1 The receiver control unit (RCU) is located on the copilot slide of the lower console.

c) Marker Beacon Antenna

Frame #3340 (Marker Beacon Antenna)



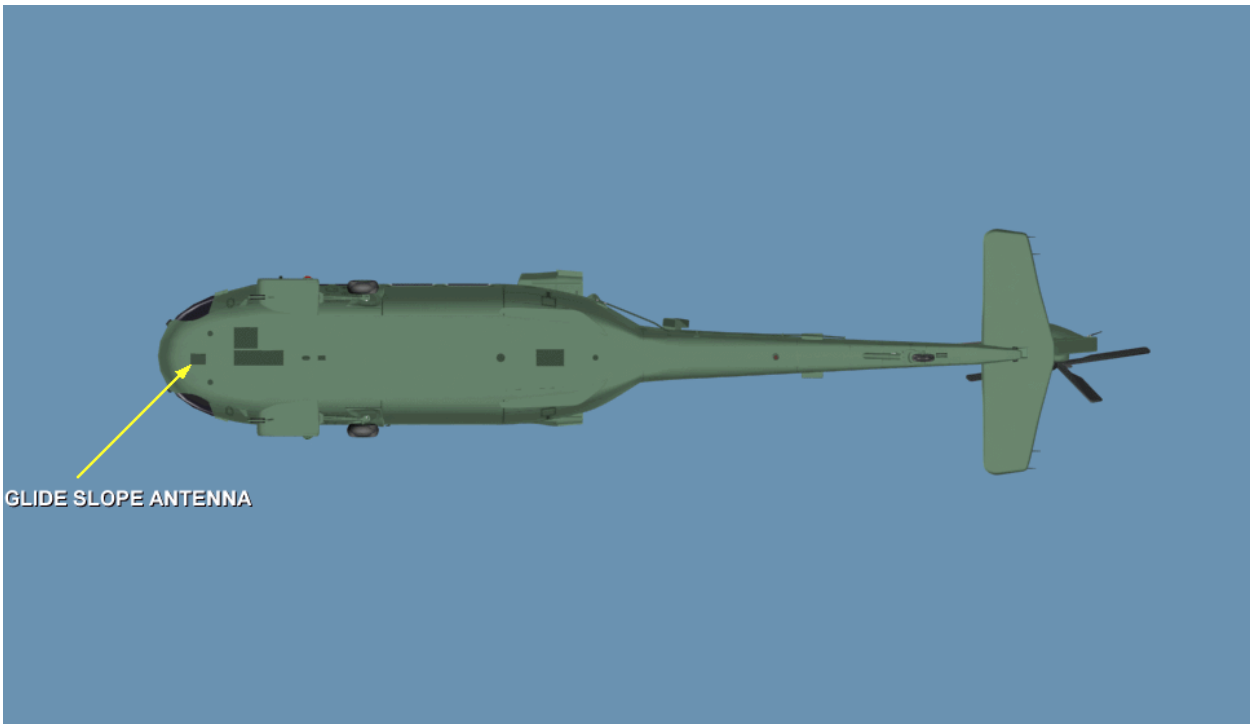
1 Marker Beacon antenna is located on the underside of the fuselage center section.

2 MB rf signals are received by the MB antenna and applied to the MB receiver section through a coaxial connector.

3 The MB rf signal is a 75 MHz carrier amplitude-modulated with a 400 Hz (outer marker), 1300 Hz (middle marker) or 3000 Hz (inner marker) tone.

d) Glide Slope Antenna

Frame #3350 (Glide Slope Antenna)



1 The Glide Slope antenna is located on the nose below the nose compartment.

2 An rf signal is received by the GS antenna and applied to a receiver through the coaxial connector marked GS.

e) VOC/LOC Antenna

Frame #3360 (VOC/LOC Antenna)

1 The two VOR/LOC antennas are located on the left and right sides of the fuselage tail cone.

2 The VOR rf signal is received by the left and right VOR/LOC antennas and applied to the VOR/LOC receiver section through a coaxial connector.

f) Pilot And Copilot HSI/VSI Mode Select Panel

Frame #3370 (Pilot And Copilot HSI/VSI Mode Select Panel)

1 The bottom row permits each pilot to transfer VSI gyro and turn rate inputs, select HSI CRS and HDG outputs, and select HSI No. 2 pointer input circuits.

2 All visual navigation signals, except Marker Beacon (MB), are applied to the pilot and copilot Horizontal Situation Indicator/Vertical Situation Indicator (HSI/VSI) mode select panels for display on their respective VSI and HSI.

3 These signals are also applied to the Command Instrument Set (CIS) for processing as ILS steering indications on the pilot and copilot VSI. MB signals are applied directly to the pilot and copilot VSI.

g) Pilot and Copilot VSI

Frame #3380 (Pilot and Copilot VSI)

1 Helicopter pitch and roll attitudes, referenced to a level attitude, are sensed by both gyros.

2 The gyros apply the pitch and roll attitude signals through the HSI/VSI mode select panels to the attitude indicator portion of the VSI for visual display circuits.

3 All visual navigation signals, except MB, are applied to the pilot and copilot Horizontal Situation Indicator/Vertical Situation Indicator (HSI/VSI) mode select panels for display on their respective VSI and HSI.

4 These signals are also applied to the Command Instrument Set (CIS) for processing as ILS steering indications on the pilot and copilot VSI.

5 MB signals are applied directly to the pilot and copilot VSI.

h) Pilot and Copilot HSI

Frame #3390 (Pilot and Copilot HSI)

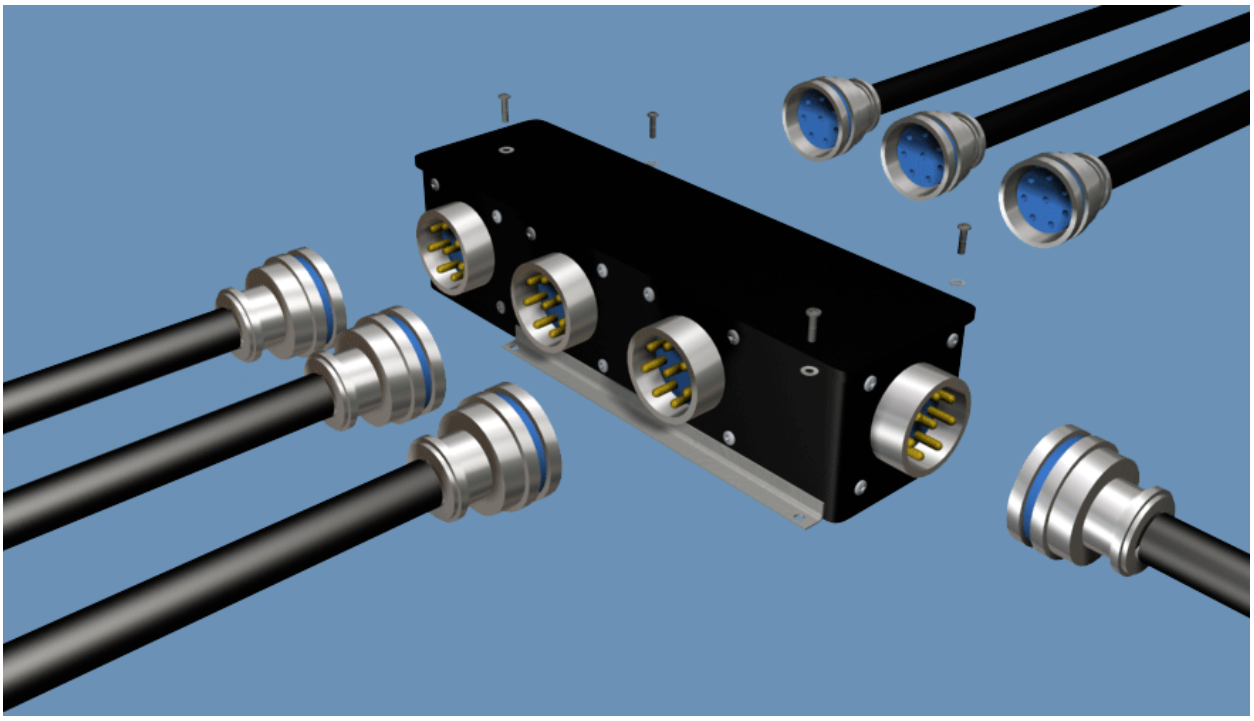
1 Two Horizontal Situation Indicators (HSI) are installed on the instrument panel, one in front of each pilot.

2 The heading information is applied to the pilot and copilot HSI for a visual indication of helicopter headings.

3 The bearing signal is applied to the pilot and copilot HSI/VSI mode select panels and, when selected, drives the No. 2 pointer on the respective HSI to indicate relative VOR station bearing with respect to helicopter heading.

i) Audio Junction Box

Frame #3400 (Audio Junction Box)



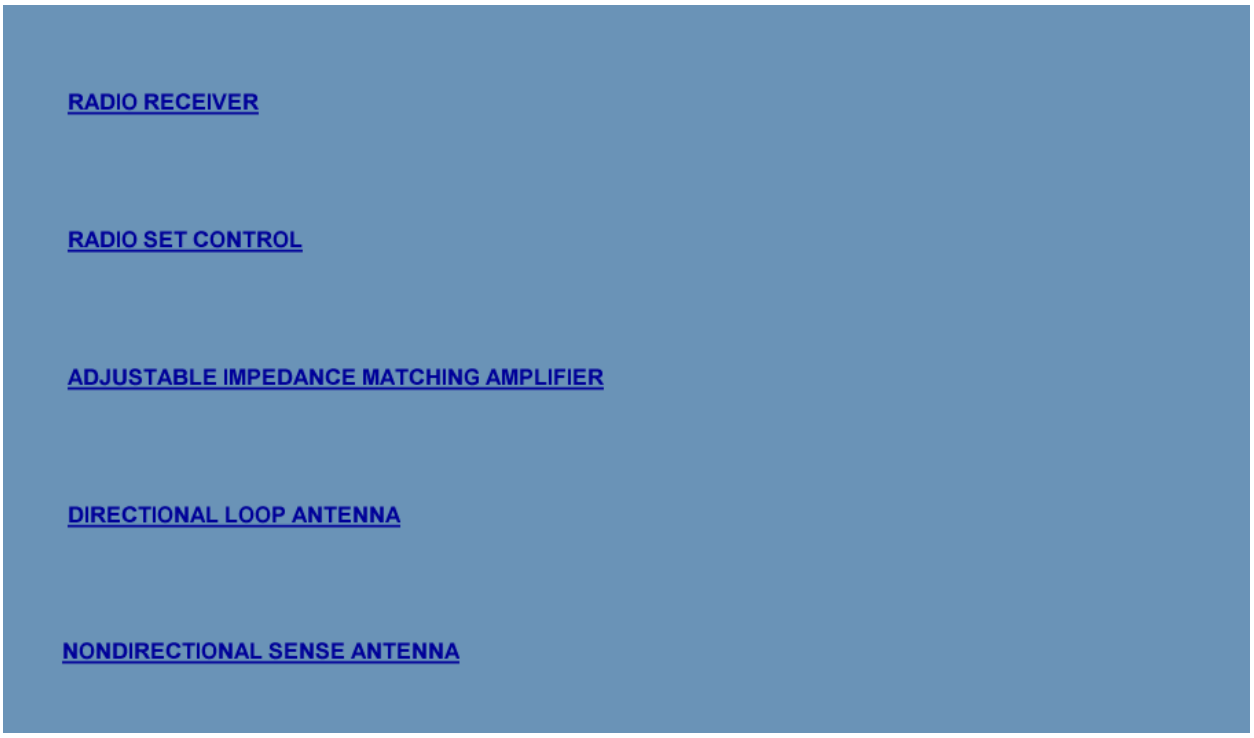
1 The Audio Junction Box is located below lower console radios. All intercom and radio transmission/reception goes through the junction box.

2 Audio from IFF, radar warning set, VOR/LOC, ADF, Marker Beacon, engine out, low rotor and stabilator passes through the junction box.

3 Also flood light control voltage to the cabin and troop commander ICS.

(f) LF/ADF Set (AN/ARN-89)

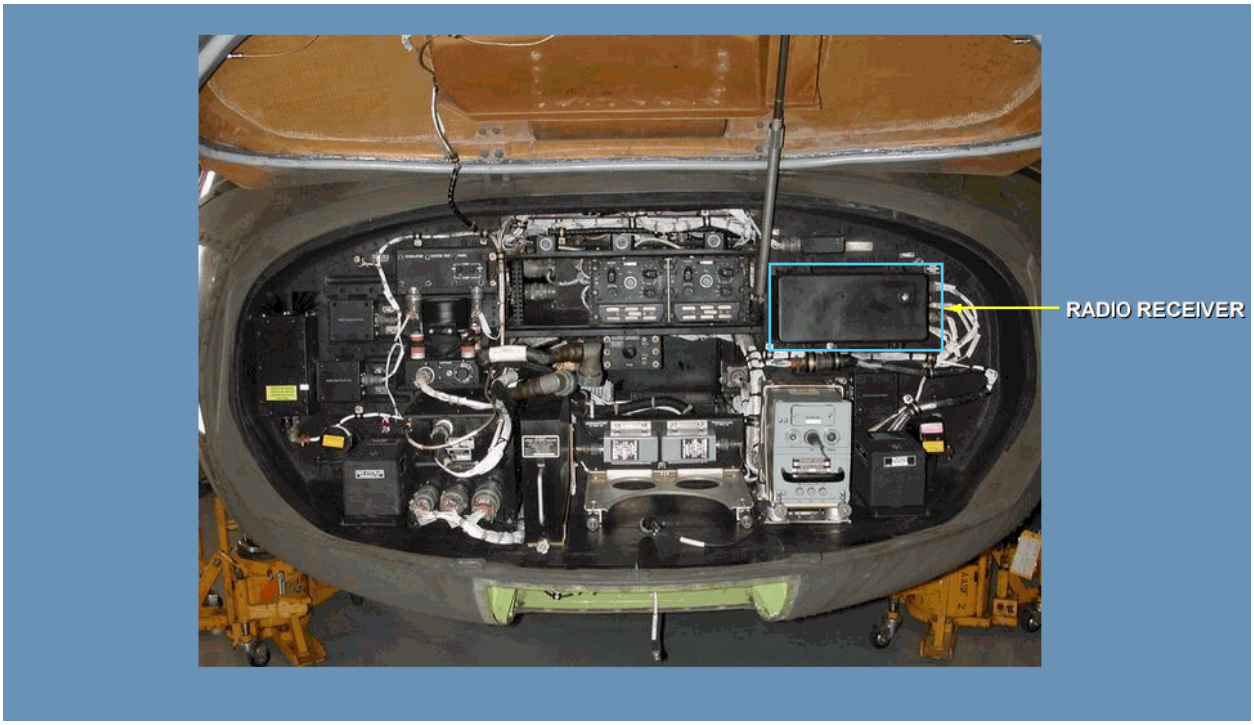
Frame #3500 (LF/ADF Set (AN/ARN-89)



1) The Low Frequency/Automatic Direction Finder (LF/ADF) (AN/ARN-89) Set provides manual and automatic direction finding capability for radio signals within the frequency range of 100 kHz to 3000 kHz.

a) Radio Receiver

Frame #3510 (Radio Receiver)



1 The radio receiver is located in the nose compartment.

2 It interfaces with the Horizontal Situation Indicator/Vertical Situation Indicator (HSI/VSI) mode select unit, the audio junction box assembly (junction box), and the Intercommunication Set (ICS).

b) Radio Set Control

Frame #3520 (Radio Set Control

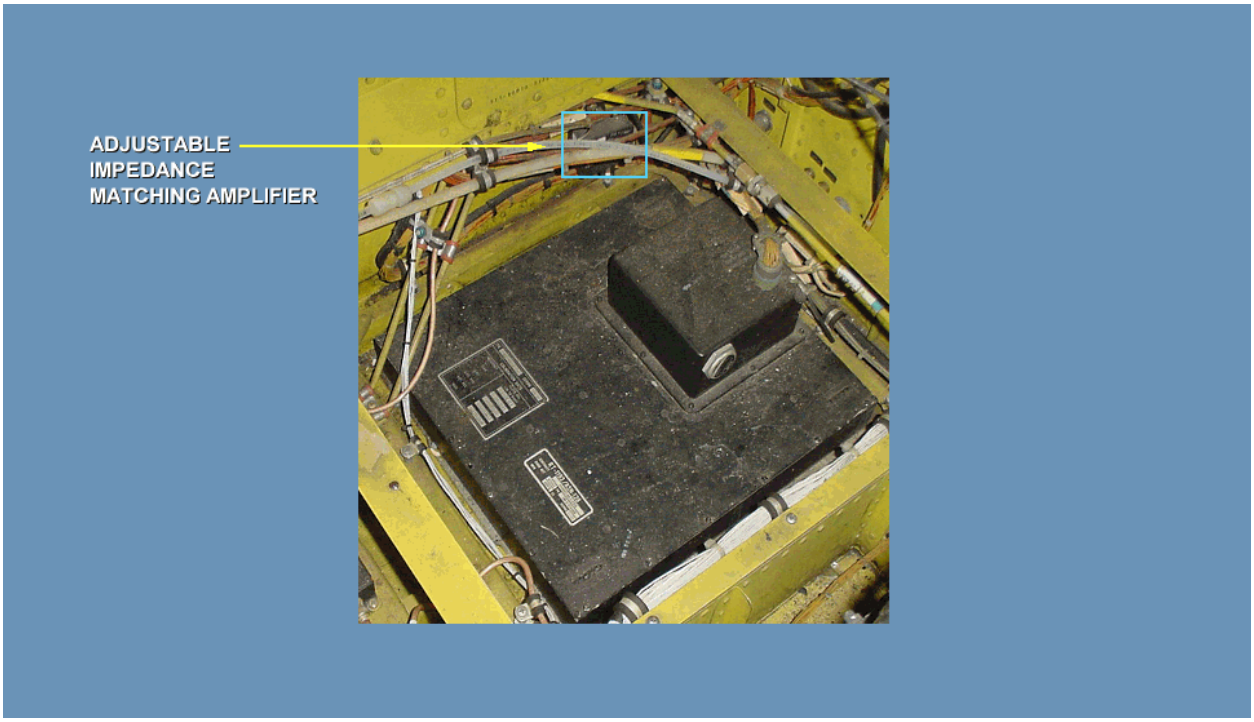
1 The radio set control (RSC) is located on the copilot side of the lower console.

2 The RSC has a four-position mode select switch labeled OFF, COMP, ANT, and LOOP.

3 The LOOP control switch is labeled LOOP, with the setting positions of L and R, a CW/VOICE/TEST switch, an AUDIO volume/gain control switch, a vertical scale presentation TUNE meter, 100 kHz course and 1 kHz fine tune frequency select knobs, and a KILOCYCLES readout window displaying selected frequency.

c) Adjustable Impedance Matching Amplifier

Frame #3530 (Adjustable Impedance Matching Amplifier)



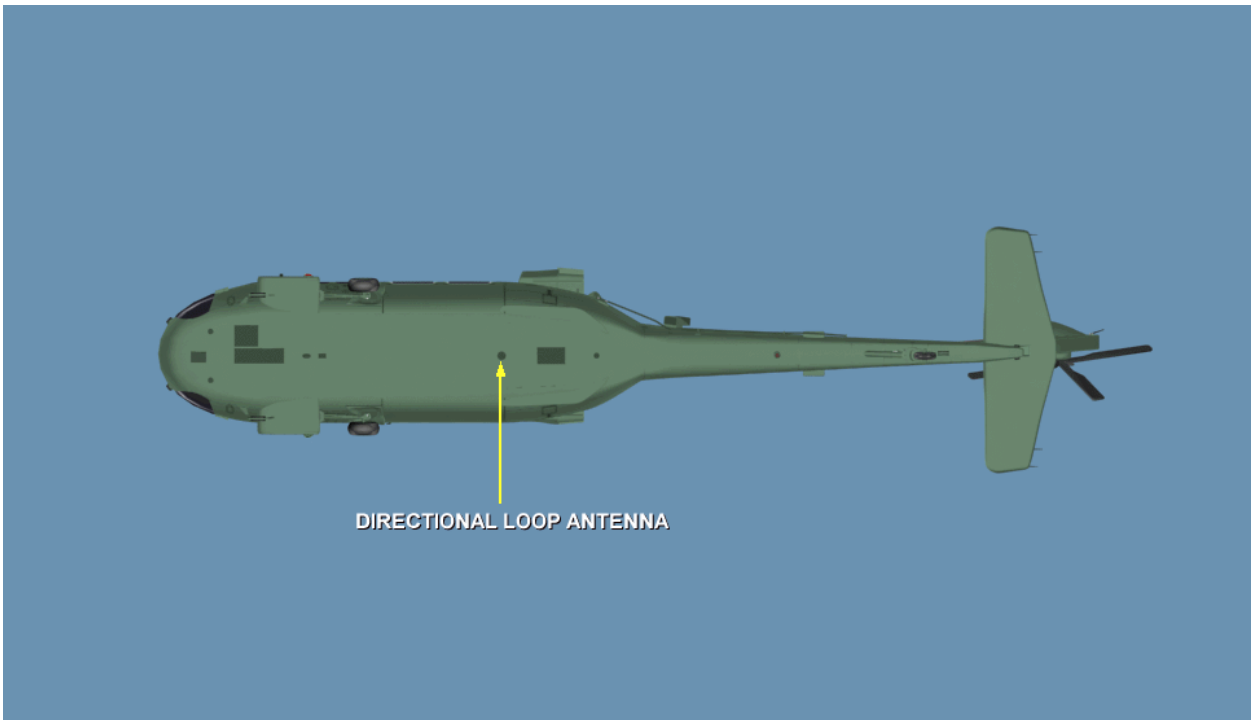
1 The adjustable Impedance Matching Amplifier (IMA) is located on the underside of the cabin, in the nose compartment.

2 The signal received at the quad antenna is amplified by the IMA.

3 The quad antenna is located on the underside of the cabin and contains the No. 2 VHF/FM, VHF/AM, ADF Sense antennas.

d) Directional Loop Antenna

Frame #3540 (Directional Loop Antenna)



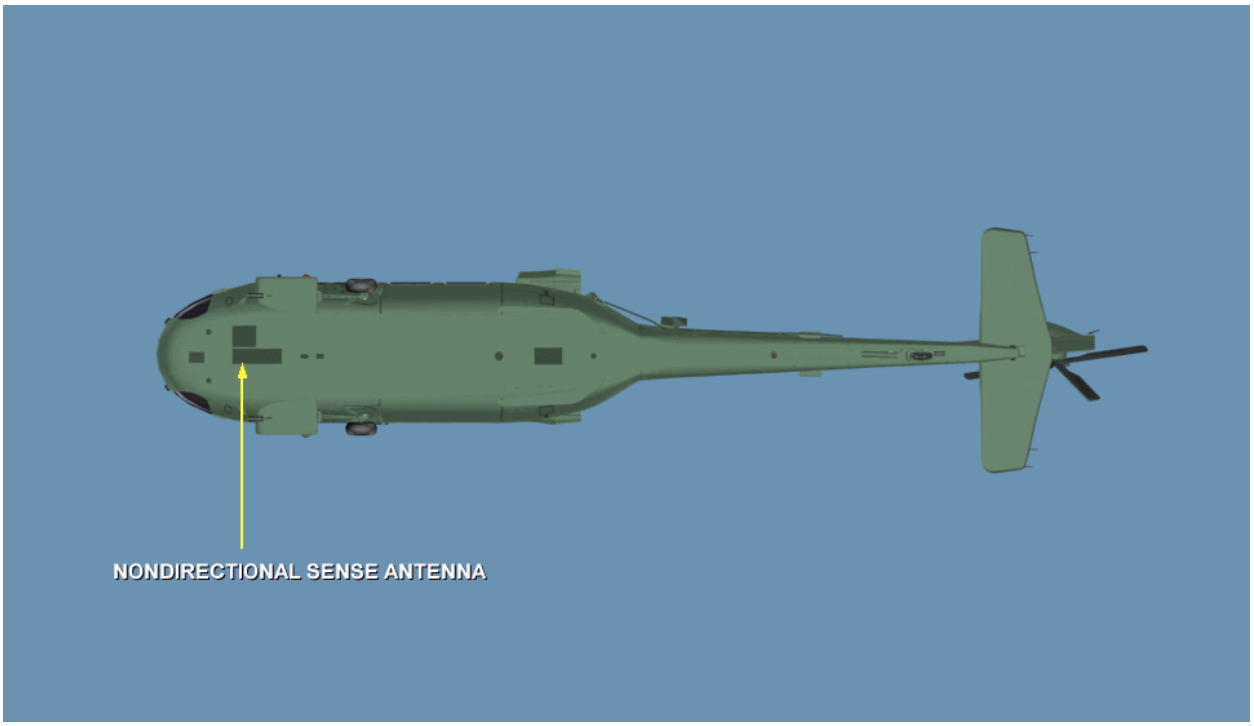
1 The Directional Loop Antenna is located on the underside of the aircraft, aft of the cargo hook.

2 Signals from the loop antenna are supplied directly to the receiver.

3 The ADF bearing signal produced by the receiver represents the true bearing of the tuned station relative to the helicopter course.

e) Nondirection Sense Antenna

Frame #3550 (Nondirectional Sense Antenna)

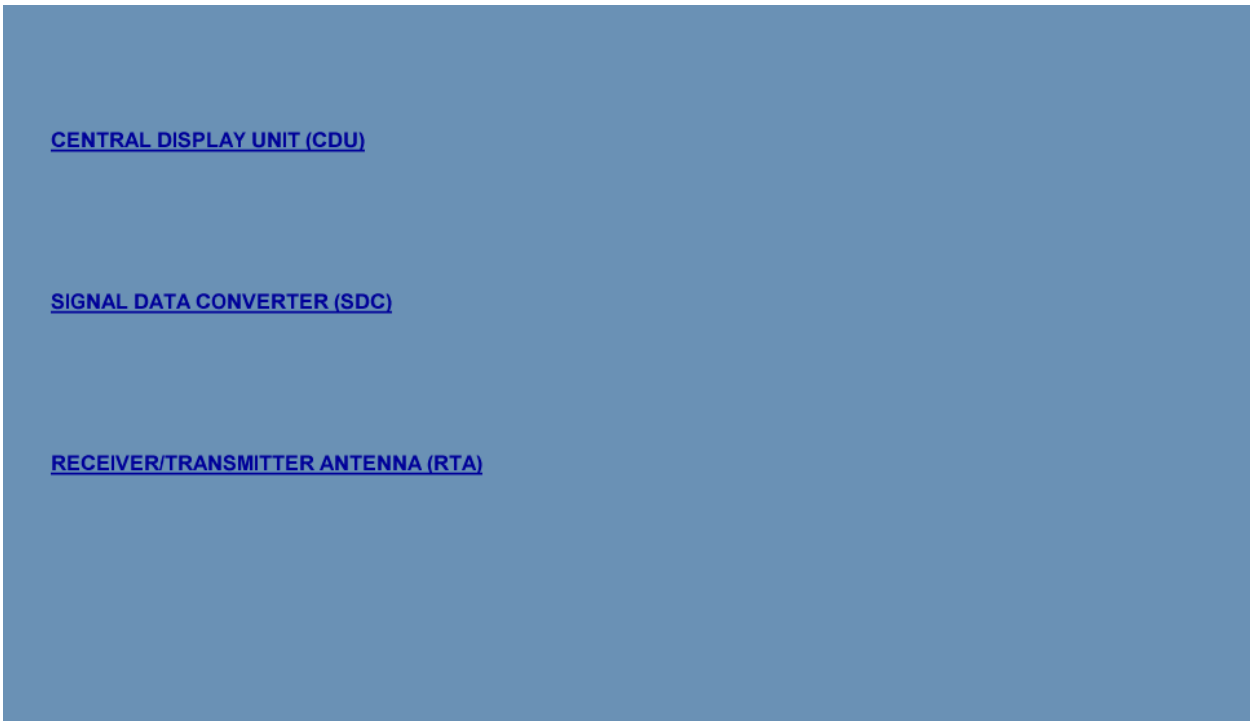


1 The Nondirectional Sense Antenna is located on the underside of the aircraft in the Quad Antenna and also contains the No. 2 VHF/FM, VHF/AM antennas.

2 In the ANT mode provides radio reception uses only the quad antenna.

(g) Doppler/GPS Navigation Set (AN/ASN-128B)

Frame #3600 (Doppler/GPS Navigation Set (AN/ASN-128B)



1) Doppler/Global Positioning Set (GPS) Navigation (AN/ASN-128B) Set (DGNS) is an Airborne Navigational Set that determines the three orthogonal components of helicopter velocity from measurements of the Doppler frequency shift.

2) It computes present position and bearing, time, and distance to selected destinations from internal GPS measurements and Doppler frequency shift measurements.

a) Central Display Unit (CDU)

Frame #3610 (Central Display Unit (CDU)

1 The CDU contains all operating controls, indicators, and displays of the Doppler/GPS Navigational Set.

2 It also contains a keyboard to permit data entry into memory.

3 On the back of the unit is a dry cell battery which prevents loss of data from computer memory when power is turned off.

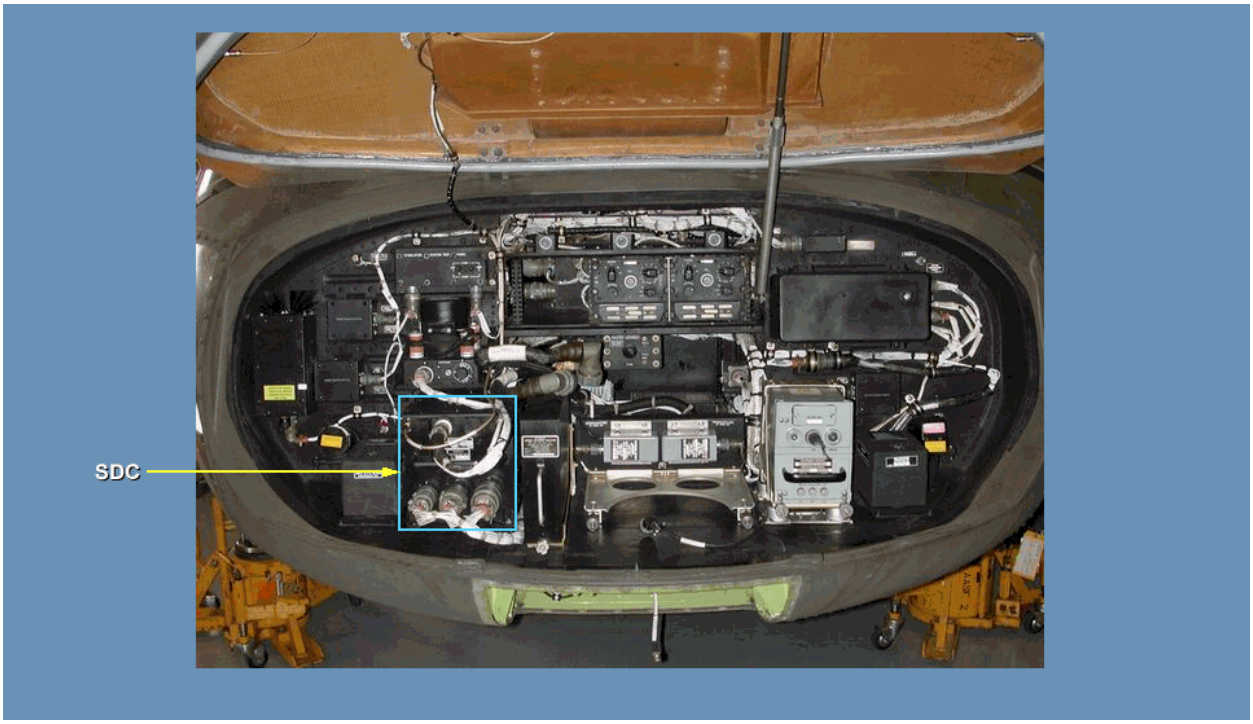
4 The set functionally interfaces with the Horizontal Situation Indicator/Vertical Situation Indicator (HSI/VSI) mode select unit for display of Doppler distance bearing and course information on both Horizontal Situation Indicators (HSI) and Vertical Situation Indicators (VSI).

5 The set functionally interfaces with the Compass Set and the copilot vertical displacement gyro for helicopter heading and attitude reference inputs.

6 The set also supplies the Command Instrument Set (CIS) with Doppler navigation data.

b) Signal Data Converter (SDC)

Frame #3620 (Signal Data Converter (SDC)



1 The signal data converter (SDC) is located in the avionics compartment.

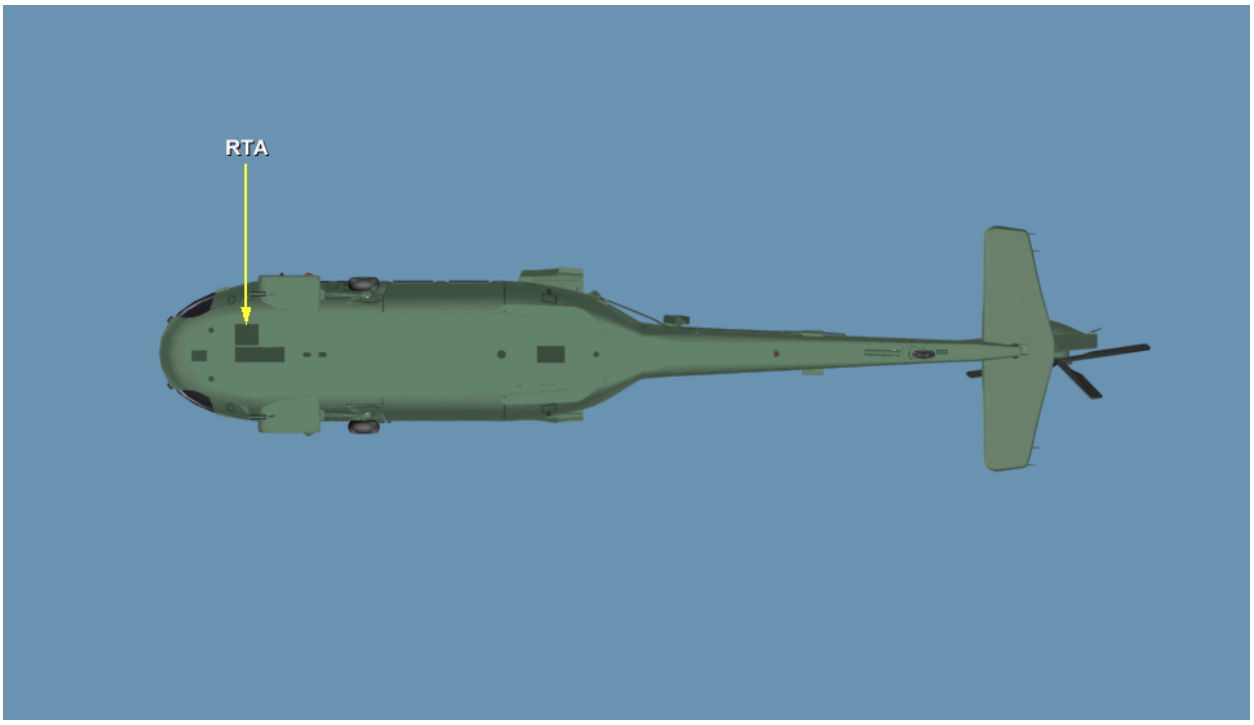
2 The SDC processes the Doppler signals, attitude and heading inputs to provide Doppler radar velocity sensor data to the CDU.

3 The SDC also provides operating voltages for the Receiver Transmitter Antenna (RTA) and computer display.

4 Electrical connection to the SDC is made through the connectors on the front of the unit.

c) Receiver/Transmitter Antenna (RTA)

Frame #3630 (Receiver/Transmitter Antenna (RTA)

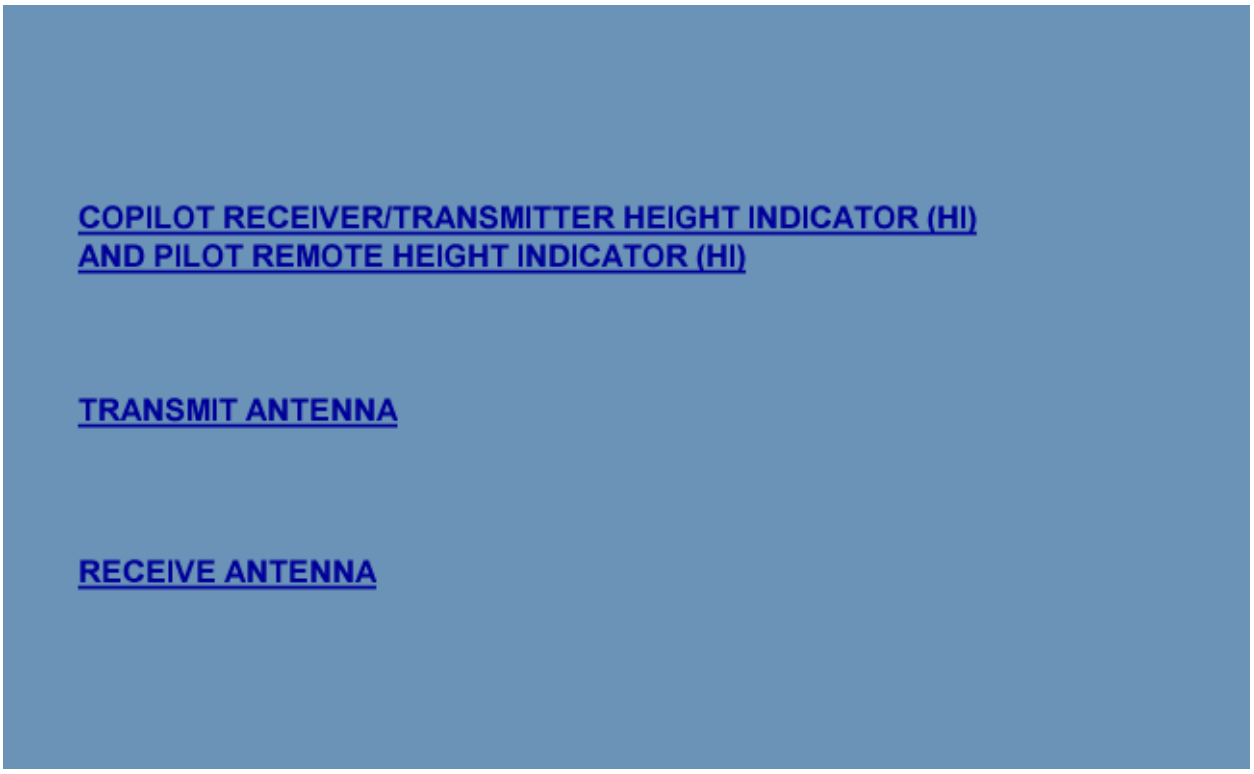


1 The Receiver/Transmitter Antenna (RTA) is located in the cockpit tub below the copilot seat.

2 The RTA consists of a combined antenna/radome with a receiver-transmitter housing mounted on top.

(h) Radar Altimeter Set (AN/APN-209)

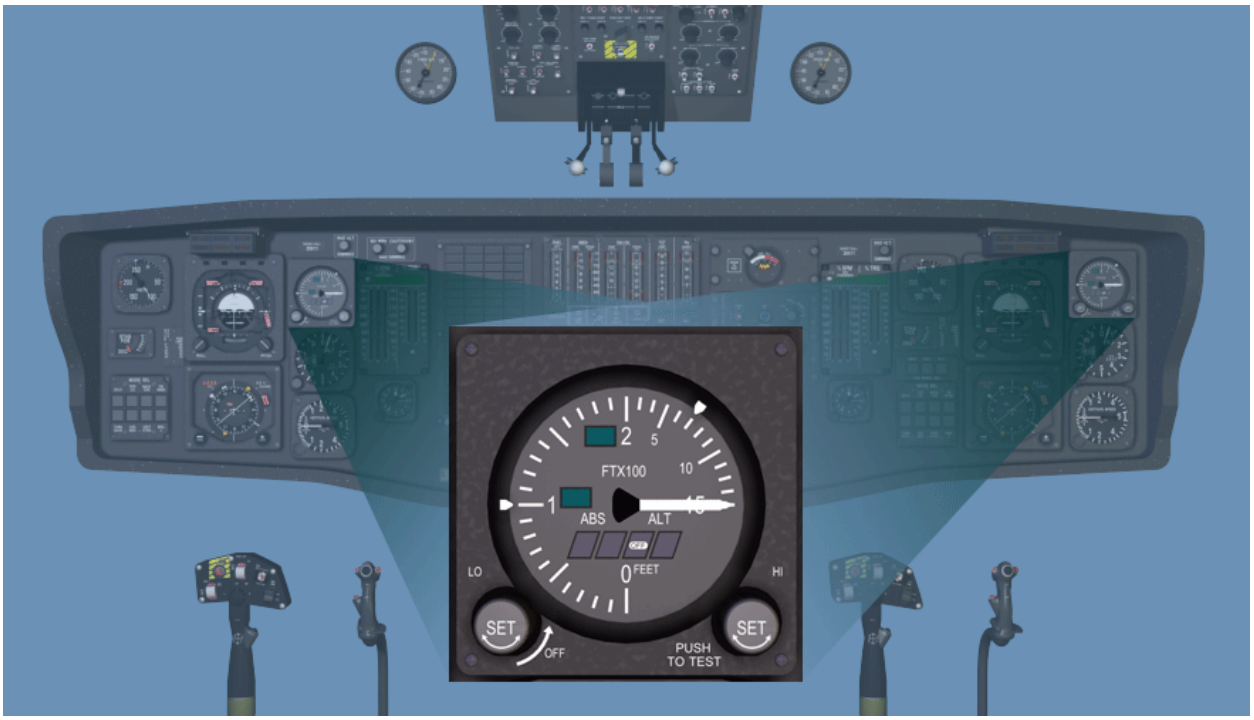
Frame #3700 (Radar Altimeter Set AN/APN-209)



1) The Radar Altimeter (AN/APN-209) Set is a high resolution pulse radar, terrain-tracking set that gives the pilot and copilot a constant visual display of the helicopter's height in feet, with respect to the immediate terrain.

a) Copilot Receiver/Transmitter Height Indicator (HI) and Pilot Remote Height Indicator (HI)

Frame #3710 (Copilot Receiver/Transmitter Height Indicator (HI) and Pilot Remote Height Indicator (HI)



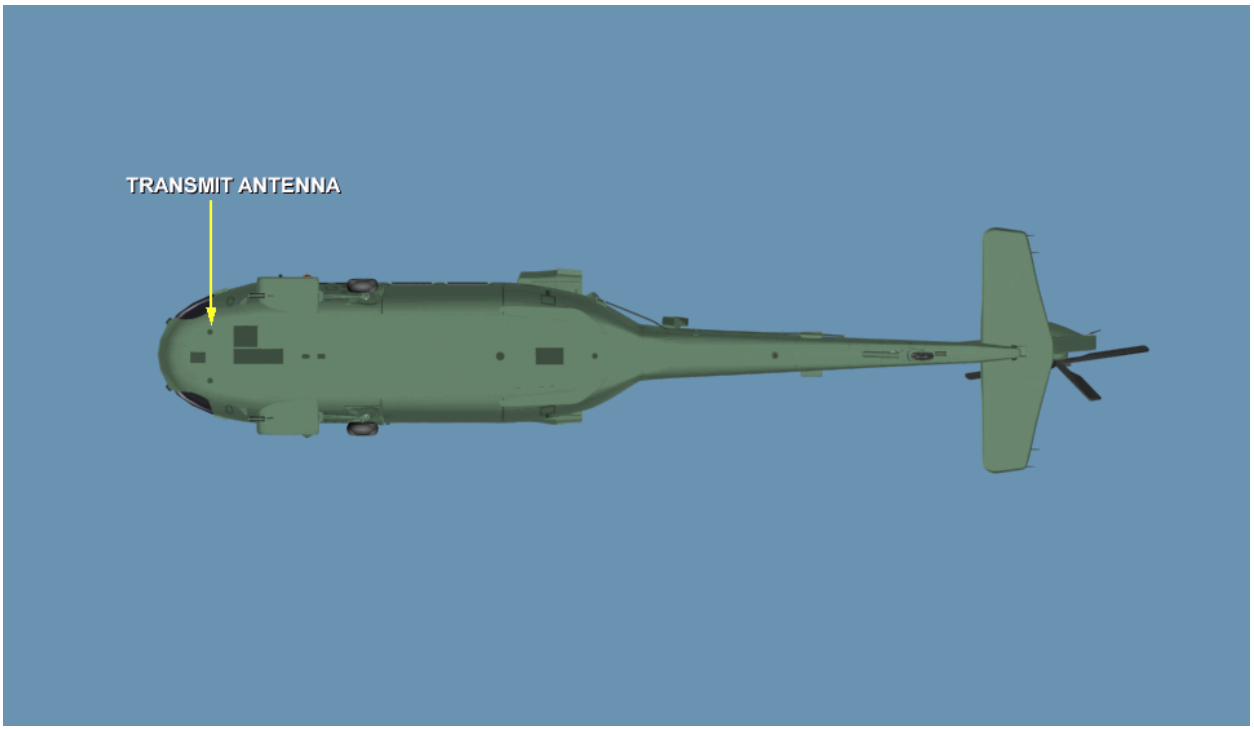
1 The Radar Altimeter (AN/APN-209) Set is a high resolution pulse radar, terrain-tracking set that gives the pilot and copilot a constant visual display of the helicopter's height in feet, with respect to the immediate terrain.

2 The set functionally interfaces with both Vertical Situation Indicators (VSI) and Command Instrument Set (CIS) to give a visual signal on the VSI of predetermined operating conditions.

3 The pilot and copilot radar altimeter indicators are not interchangeable.

b) Transmit Antenna

Frame #3720 (Transmit Antenna)

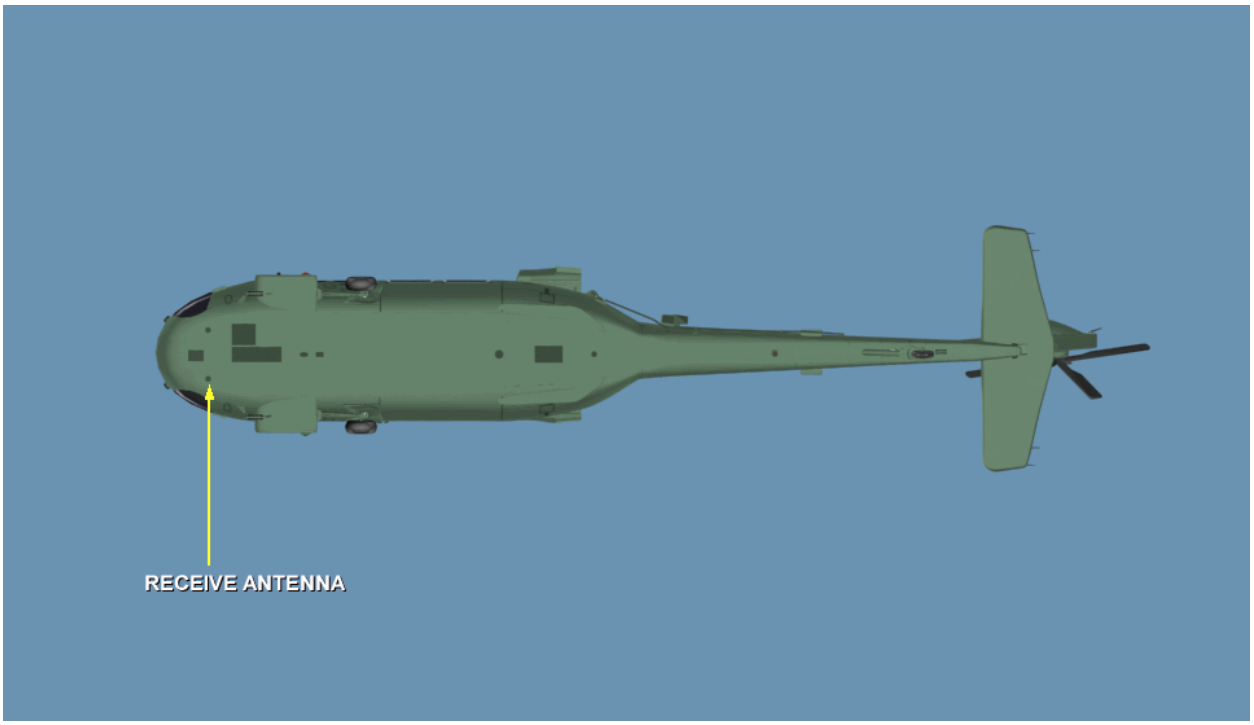


1 The transmit antenna is located on the underside of the nose section left side.

2 The transmitter portion generates a steady train of short pulses which are radiated from the transmit antenna.

c) Receive Antenna

Frame #3730 (Receive Antenna)



1 The receive antenna is located on the underside of the nose section right side.

2 Reflections of the transmitted pulses are sent by the receive antenna and applied to the receiver circuits for amplification and processing.

Check on Learning

1. What component compensates for deviations caused by unwanted magnetic fields?

2. How many feet away from the aircraft should a tug be placed during a compass swing?

3. Which component displays pitch and roll attitude, turn rate, slip and skid?

4. What navigational set computes present position and bearing, time, and distance to a selected destinations?

5. What antenna is not contained inside the Quad Antenna?

6. What component provides turn rate information for the Pilot and Copilot VSI?

SECTION V. -SUMMARY

1. REVIEW/SUMMARIZE:

You have completed the identification of components of the UH-60 Navigational system topic.

The key points to remember are:

- Deviation that may be caused by unwanted magnetic fields is compensated by the magnetic compensator.
- The Gyromagnetic Compass (AN/ASN-43) Set provides accurate heading information that is either slaved to the earth's magnetic field when operating in the SLAVED mode or referenced to a free directional gyro heading when operating in the FREE mode. The heading information is applied to the pilot and copilot Horizontal Situation Indicators (HSI) for a visual indication of helicopter headings.
- Two Horizontal Situation Indicator (HSI) are installed on the instrument panel, one in front of each pilot. The heading information is applied to the pilot and copilot (HSI) for a visual indication of helicopter headings.
- The Vertical Situation Indicator (VSI) displays pitch and roll attitude, turn rate, slip and skid, and Command Instrument Set (CIS) steering commands.
- Each HSI/VSI mode select panel has two rows of four selector switches. The top row of switches selects a particular navigation function for display on the VSI and HSI. The bottom row permits each pilot to transfer VSI gyro and turn rate inputs, select HSI CRS and HEADING outputs, and select HSI No. 2 pointer input.
- The two types of CIS Processors are Analog and Digital. The processor receives inputs from the AFCS, Baro-altimeter, pilot vertical gyro, AN/ASN-43, and radar altimeters, navigational inputs from the Civil Navigation Set and Doppler/GPS.
- The Radar Altimeter (AN/APN-209) Set is a high-resolution pulse radar, terrain-tracking set that gives the pilot and copilot a constant visual display of the helicopter height in feet, with respect to the immediate terrain. The set functionally interfaces with both Vertical Situation Indicators (VSI) and Command Instrument Set (CIS) to give a visual signal on the VSI of predetermined operating conditions. The Pilot and Copilot radar altimeter indicators are not interchangeable.
- The Civil Navigation (AN/ARN-123) Set receives Very High Frequency (VHF) Omnirange (VOR), Localizer (LOC), Glide Slope (GS), and Marker Beacon (MB) signals to provide the pilot and copilot with visual and aural VOR/Instrument Landing Set (ILS) information. Visual information permits manual VOR, automatic VOR bearing, LOC, GS, and MB indications. Aural information permits voice and code identification of VOR/LOC and MB signals.
- The Low Frequency/Automatic Direction Finder (LF/ADF) (AN/ARN-89) Set provides manual and automatic direction finding capability for radio signals within the frequency range of 100 kHz to 3000 kHz.
- Doppler/Global Positioning Set (GPS) Navigation (AN/ASN-128B) Set (DGNS) is an Airborne Navigational Set that determines the three orthogonal components of helicopter velocity from measurements of the Doppler frequency shift. It computes present position and bearing, time, and distance to selected destinations from internal GPS measurements and Doppler frequency shift measurements.

D. ENABLING LEARNING OBJECTIVE ELO No.4

ACTION: List the components of the communications systems of the UH-60.

CONDITION: Given TM 11-1520-237-23-3/4.

STANDARD: IAW TM 11-1520-237-23-3/4.

a. Intercommunication Set Equipment Description

Frame #4100 (Intercommunication Set Equipment Description MENU)

(1) The Intercommunication set consists of 5 ICS control panels, audio junction box, 2 audio transformers, and 5 ICS transmission keys.

(a) Intercommunications Set (ICS) Control Panels

Frame #4105 (Intercommunications Set (ICS) Control Panels)

1) There are 5 ICS control panels: crew chief/right gunner, left gunner, and troop commander, pilot and copilot.

2) The control panels amplify the received audio and apply it to the headsets at stations where the set reception is selected.

3) The transmit audio modulates the transmitter signal, and after amplification, becomes the output.

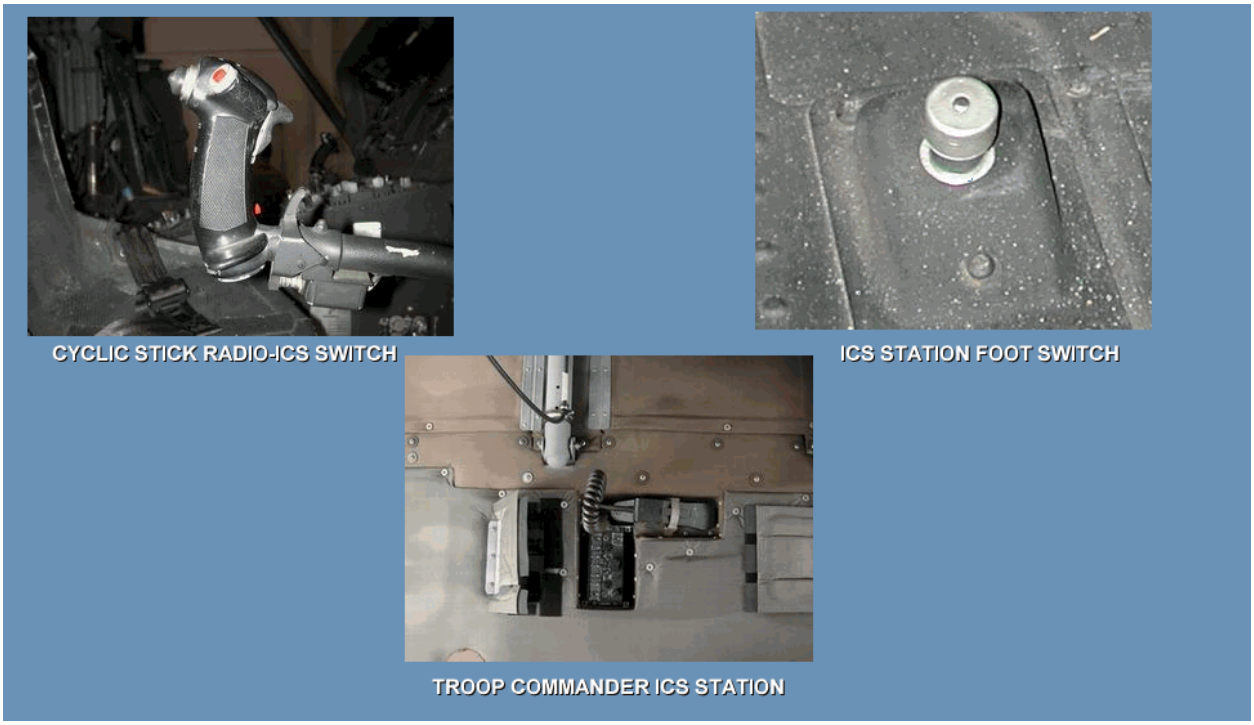
4) This output is applied to the signal data comparator coupler circuit, the Improved Frequency Modulation (IFM) amp bypass, and the low-pass filter to the shared communications antenna.

5) A portion of the transmit audio is switched back to the ICS control panels as sidetone audio on the same lines as received audio.

6) The control panels amplify the received audio and apply it to the headsets at stations where the set reception is selected.

(b) ICS Transmission Keys

Frame #4110 (ICS Transmission Keys)



1) The pilot and copilot can also key ICS transmission with the control panel rotary switch placed to any position and the cyclic stick RADIO-ICS switch pressed to ICS.

2) ICS transmission keying is done at each station with the control panel rotary switch placed to ICS and the station foot switch, headset-microphone connector key switch, or handset key switch pressed.

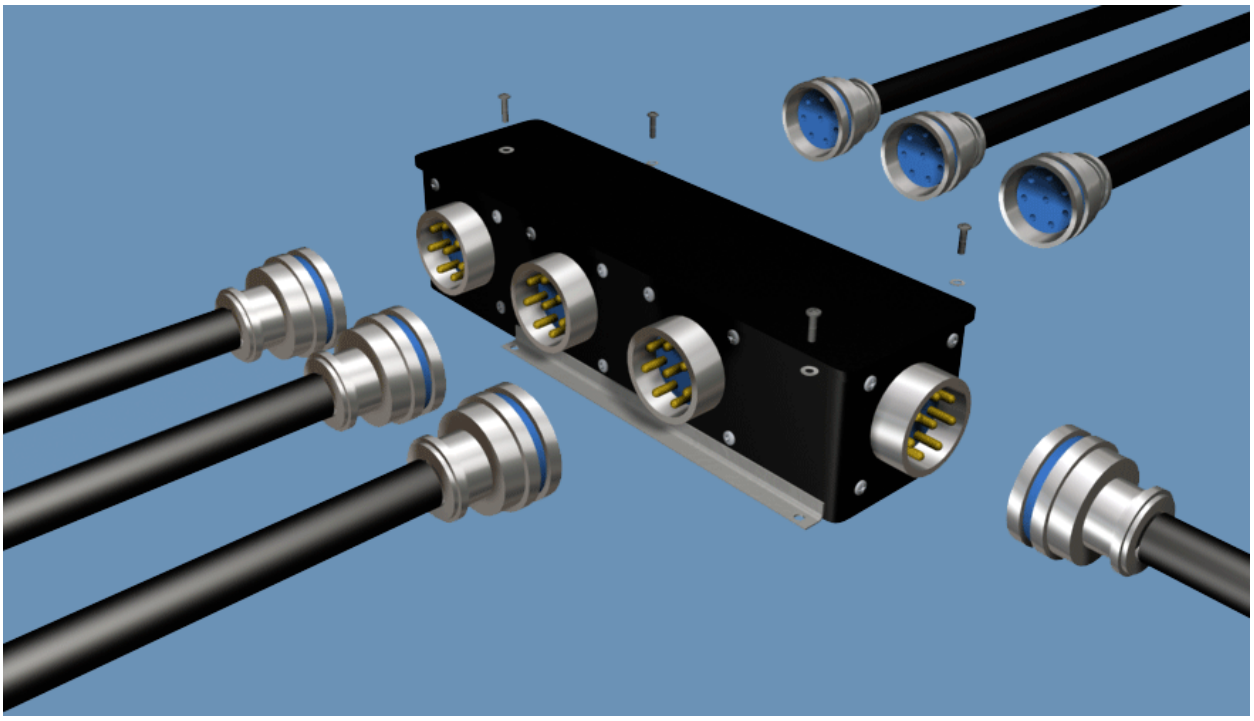
3) In addition to the five ICS stations, two external connectors and one 50-foot walkaround cord with key switch, allow maintenance personnel to communicate with crewmembers during ground operation.

4) The external connectors are located on the right and left sides to the rear of the cockpit doors and above the cockpit floor line, are connected to the right and left gunner control panels.

5) The walkaround cord is stored on the pilot seat back, below the right gunner window.

(c) Audio Junction Box

Frame #4115 (Audio Junction Box)



1) The Junction Box is located below lower console radios.

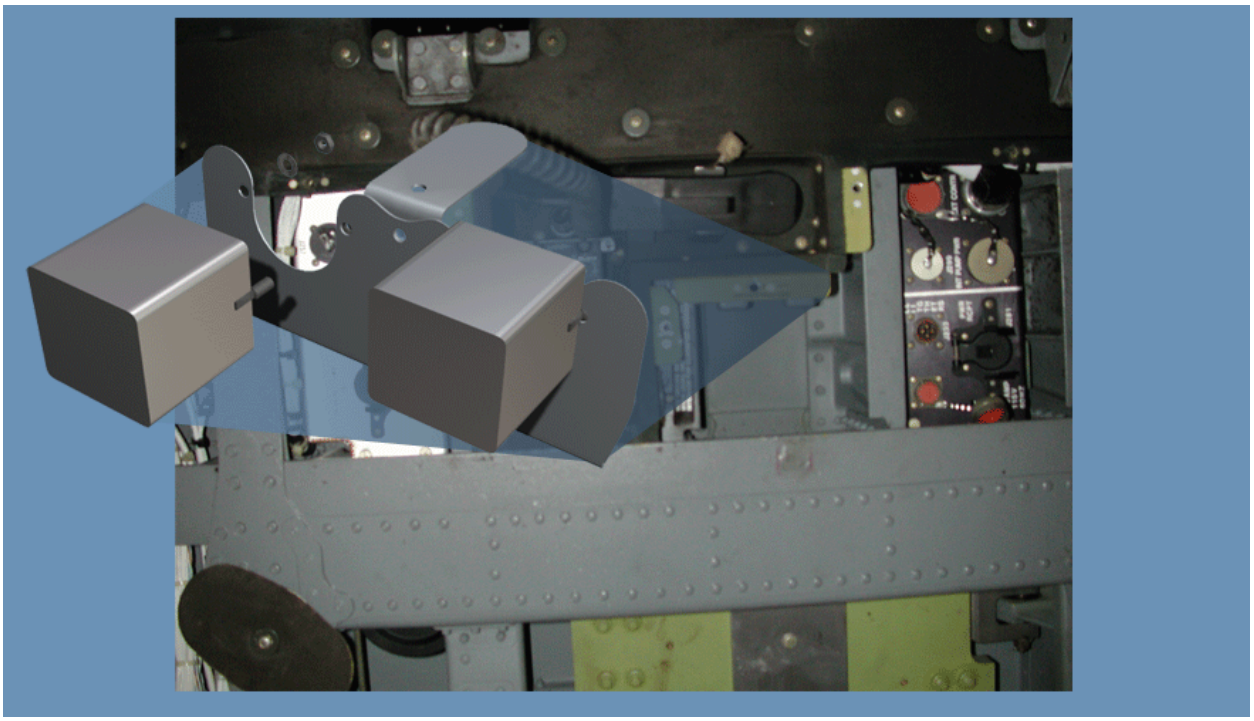
2) All intercom and radio transmission/reception goes through the audio junction box.

3) Audio from IFF, radar warning set, VOR/LOC, ADF, Marker Beacon, engine out, low rotor and stabilator passes through the Junction box.

4) The flood light control voltage also passes through the Audio Junction box to the cabin and troop commander ICS.

(d) Audio Transformers

Frame #4120 (Audio Transformers)

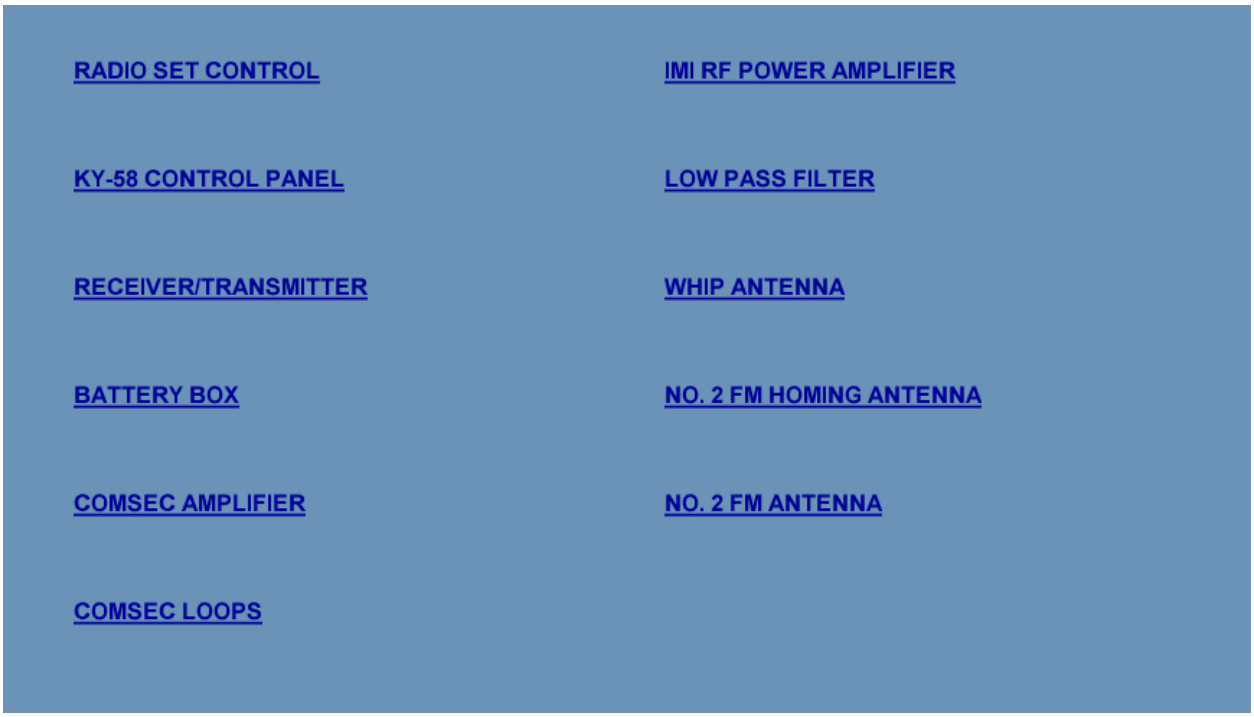


1) There are 2 audio transformers that are needed for the troop commander handset.

2) One for the mic audio and one for the handset audio.

b. No. 1 and No. 2 VHF/FM RADIO SET AN/ARC-201

Frame #4125 (No. 1 and No. 2 VHF/FM RADIO SET AN/ARC-201)



(1) The No. 1 Very High Frequency/Frequency Modulation (VHF/FM) (AN/ARC-201) Radio Set provides two-way FM voice communications on any one of 2,320 channels in the frequency range of 30.00 to 87.975 MHz in units of 25 kHz.

(2) The set is used in point-to-point clear voice, secure speech communications (COMSEC) (if installed), as a retransmission link in a radio relay system, or as a homing device.

(a) Radio Set Control Panel

Frame #4130 (Radio Set Control Panel)

1) The Radio Set Control is located on the lower console.

2) No. 1 is on the pilot side and No. 2 is on the copilot side.

(b) KY-58 Control Panel

Frame #4135 (KY-58 Control Panel)

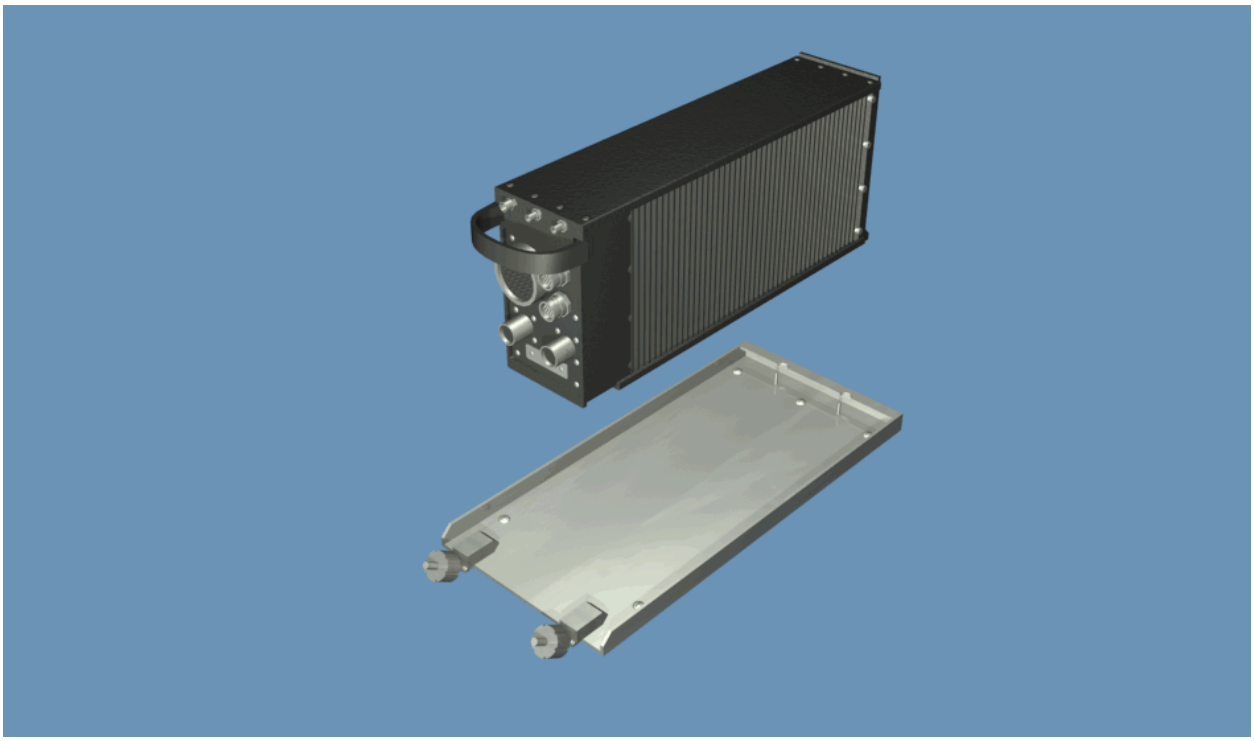
1) Both of the KY-58 control panels (COMSEC control panel) are located on the pilot side of the lower console.

2) When the COMSEC panel C/RAD 1 / PLAIN / C/RAD 2 switch is set to C/RAD 1 position, the No. 1 VHF/FM COMSEC is configured for secure speech (X-mode) operation.

3) In the secure speech mode, all transmit audio to the r/t is encoded and all received audio from the control panel is decoded by the COMSEC amp.

(c) Receiver/Transmitter

Frame #4140 (Receiver/Transmitter)



1) The receiver/transmitter is located in the pilot seatwell.

2) The receiver/transmitter amplifies and demodulates the received signal and applies the detected audio signal to an audio amplifier.

(d) Battery Box

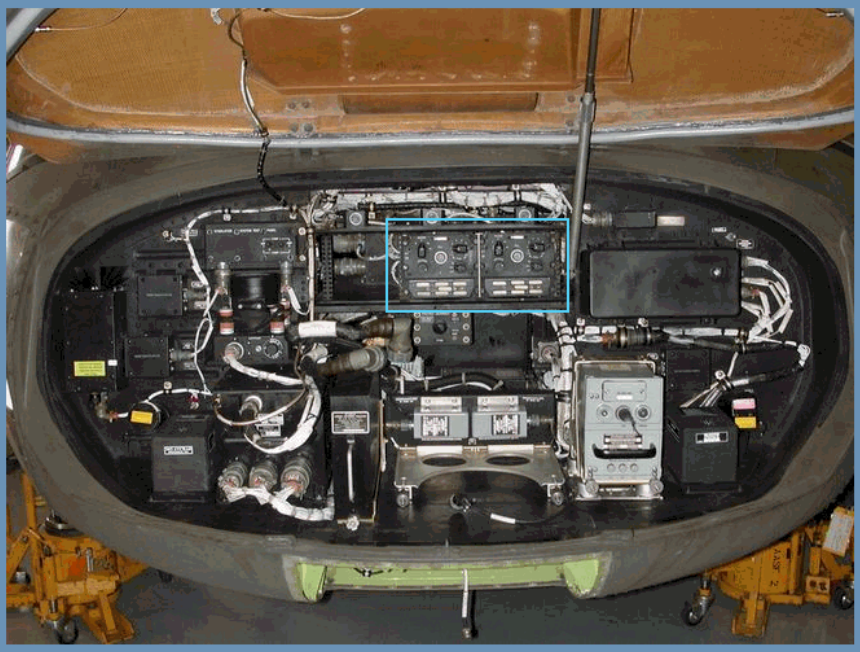
Frame #4145 (Battery Box)

1) The battery box is located in the pilot seatwell.

2) A memory hold-up battery (7.5 Vdc) is installed externally to retain ECCM memory, presets, and time.

(e) COMSEC Amplifier

Frame #4150 (COMSEC Amplifier)



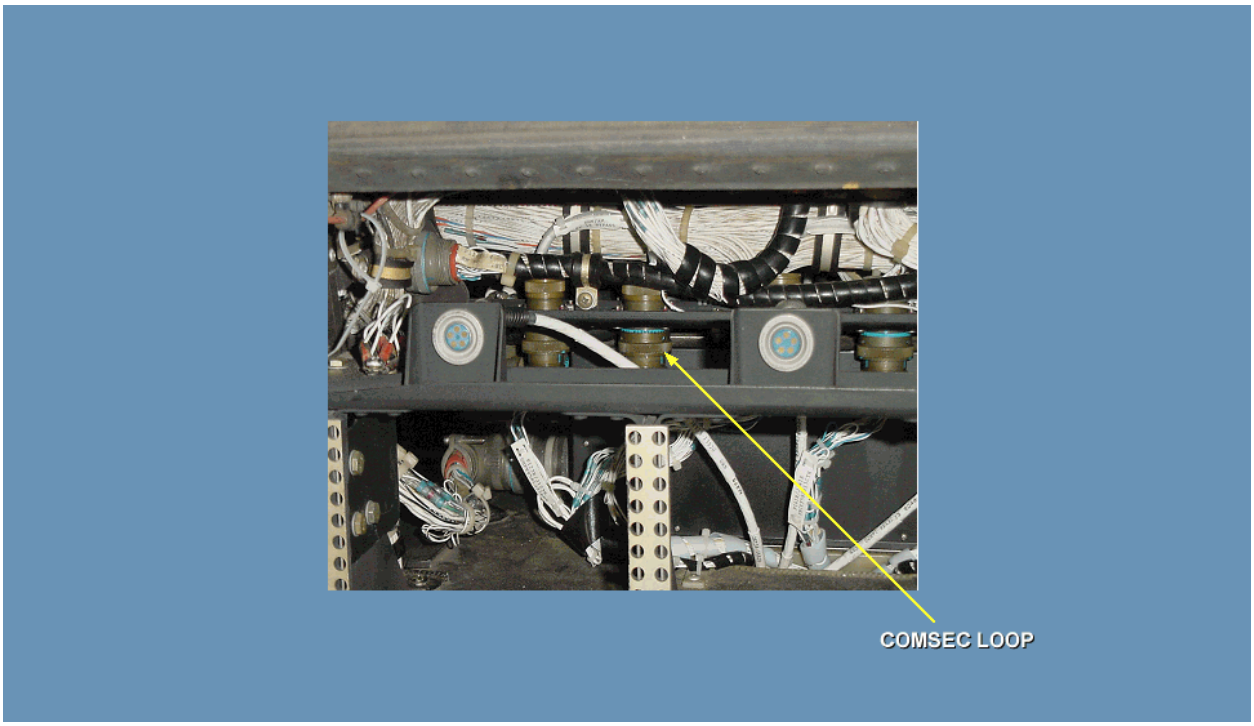
1) COMSEC amplifier (COMSEC amp) is located in the nose compartment.

2) There is one amp for each radio that is installed. During clear voice communications, the transmit audio is applied directly through the COMSEC amp to the transmitter section of the r/t.

3) The audio signal is amplified and used to modulate the rf carrier.

(f) COMSEC Loop

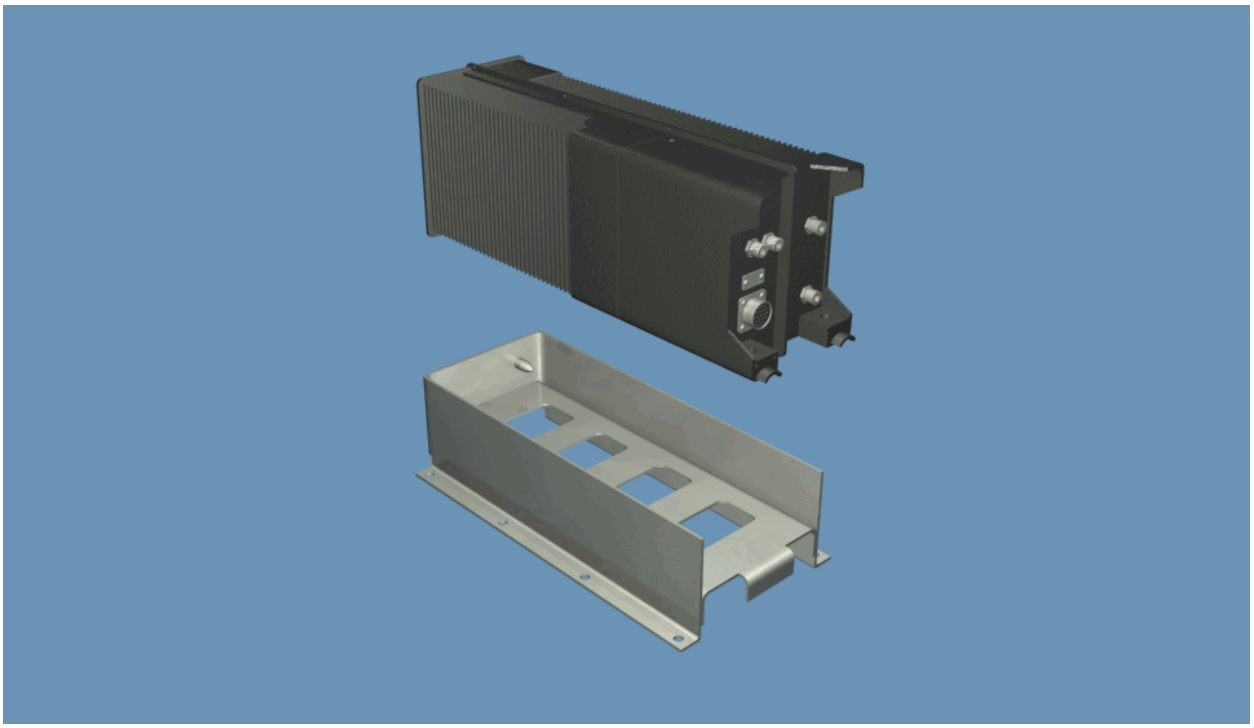
Frame #4155 (COMSEC Loop)



1) The COMSEC Jumper Harness (COMSEC LOOP) is installed when the COMSEC Amp has been removed.

(g) IFM RF Power Amplifier

Frame #4160 (IFM RF Power Amplifier)

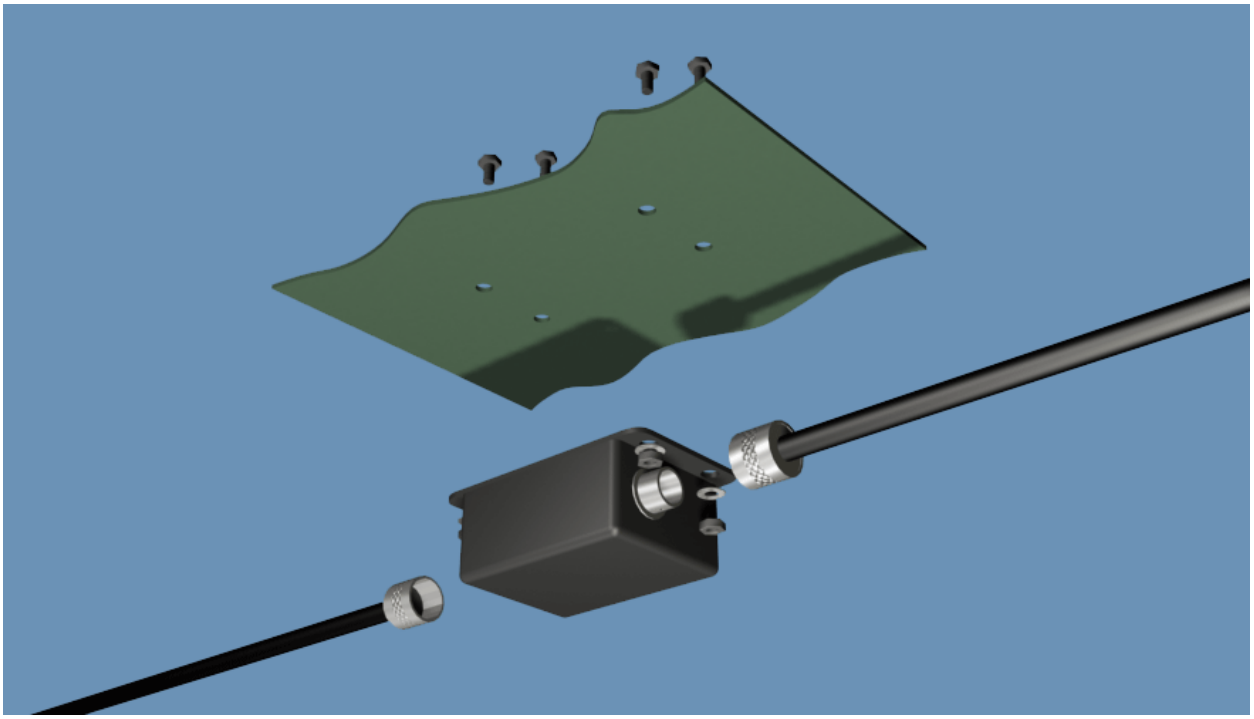


1) The IFM RF Power Amplifier is located in the transition section and is only for the No. 1 FM radio set.

2) The amp boosts the nominal 10 watt output of the Set to 40 watts.

(h) Low-Pass Filter

Frame #4165 (Low-Pass Filter)



1) The Low-Pass Filter is located in the transition section underneath the IFM amplifier mount.

2) The Low-Pass Filter filters low level interference from the IFM RF Amp to the antenna.

(i) Whip Antenna

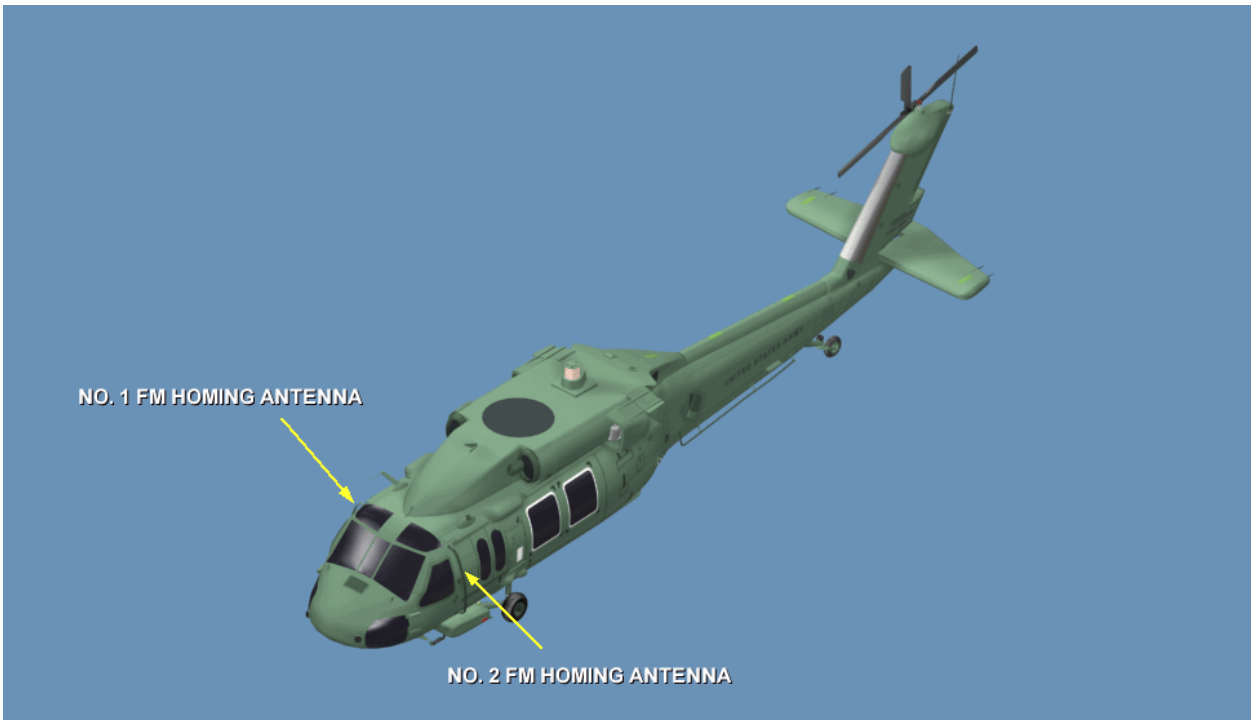
Frame #4170 (Whip Antenna)

1) The Whip Antenna is located on the tail rotor pylon for No. 1 FM radio set.

2) This antenna is used to transmit and receive VHF/FM signals for the AN/ARC- 186 radio set.

(j) FM Homing Antenna

Frame #4175 (FM Homing Antenna)



1) The two VHF/FM Homing Antennas are located on each side of the aircraft, aft of the pilot doors.

2) With the Set control panel mode select switch in DF position and FM HOME selected on the HSI/VSI mode select panels, the SDC disables inputs from the antenna and processes signals from the left and right homing antennas to display course deviation and navigation flag indications on the VSIs.

3) The left and right homing antennas monitor the left and right sides of the helicopter.

4) When the helicopter is off heading, more rf energy from the transmitting station is directed into one antenna than the other.

5) As the helicopter is corrected to an on-course heading, the rf energy received by each antenna equalizes.

(k) No. 2 FM Antenna

Frame #4180 (N0.2 FM Antenna)

1) The No. 2 FM Antenna is located on the front of the tail rotor pylon.

2) The transmit audio modulates the transmitter rf, and after amplification, becomes the r/t output.

3) This output is applied to the No. 2 FM antenna through the signal data comparator coupler circuit and the low-pass filter.

c. No.1 and No. 2 VHF/FM RADIO SET (AN/ARC-186)

Frame 4185 (No. 1 and No. 2 VHF/FM RADIO SET (AN/ARC-186)

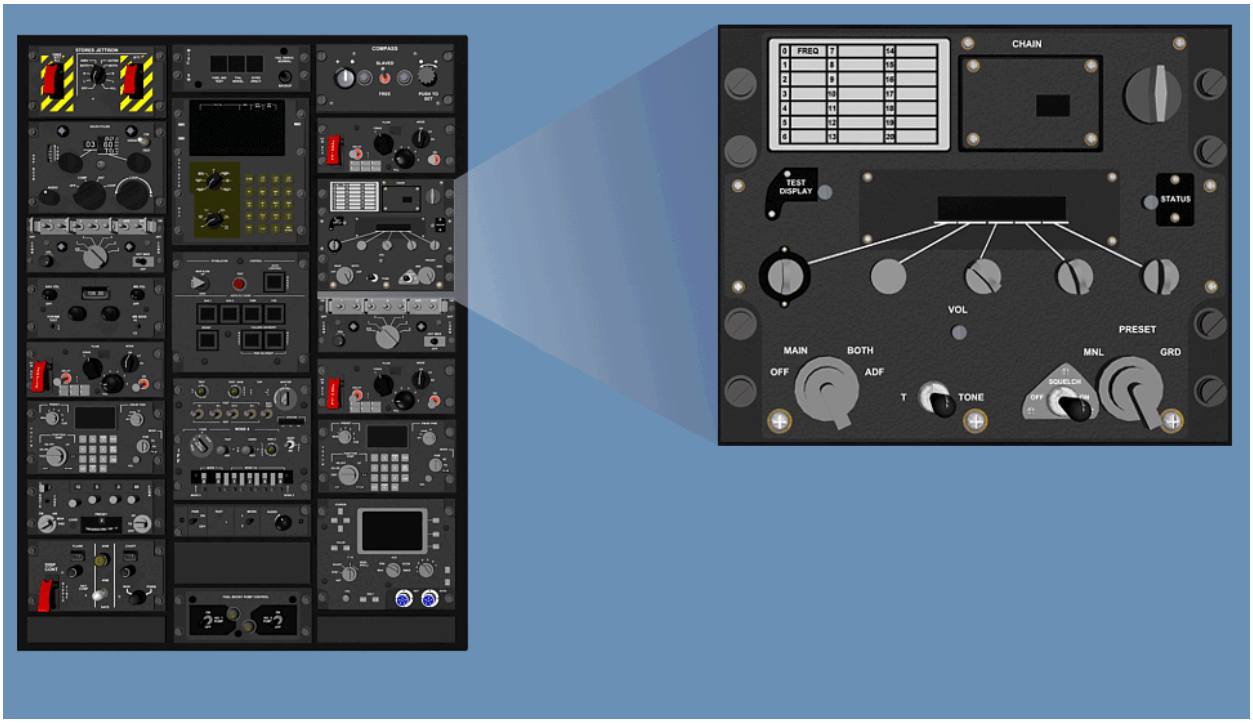
(1) The No. 1 Very High Frequency/Frequency Modulation (VHF/FM) (AN/ARC-186 (V)) Radio Set provides two-way FM voice communications on any one of 2,320 channels in the frequency range of 30.00 to 87.975 MHz in units of 25 kHz.

(2) The set is used in point-to-point clear voice, secure speech communications (COMSEC) (if installed), as a retransmission link in a radio relay system, or as a homing device.

(3) It also has an emergency mode for transmission and reception on a preselected guard frequency of 40.50 MHz.

d. UHF/AM RADIO SET (AN/ARC-164)

Frame #4195 (UHF/AM RADIO SET (AN/ARC-164)



(1) The Ultra High Frequency/Amplitude Modulation (UHF/AM) (AN/ARC-164 (V) Radio Set provides two-way AM voice communications on any one of 7,000 tunable or 20 preset channels.

(2) Three different versions are Standard, Have Quick, Have Quick ll.

(3) The set consists of: a SCRS a KY-58 control panel (COMSEC control panel), a KY-58 (COMSEC amp), and a UHF/AM antenna.

(4) The set interfaces with the Doppler/GPS Navigation Set (DGNS), the Intercommunication Set (ICS) through the audio junction box assembly (junction box), and the No. 1 Very High Frequency/Frequency Modulation (VHF/FM), No. 2 VHF/FM, and Very High Frequency/Amplitude Modulation (VHF/AM) Radio Sets through the radio retransmission control panel.

e. Transponder Set (AN/APX-100)

Frame #4200 (Transponder Set (AN/APX-100)

(1) The Transponder (AN/APX-100) Set, also known as Identification Friend or Foe (IFF) Set, provides automatic radar identification of the helicopter to all suitably-equipped challenging aircraft, surface ships, or ground facilities within the operational range of the set.

(a) Radar Receiver/Transmitter

Frame #4205 (Radar Receiver/Transmitter)

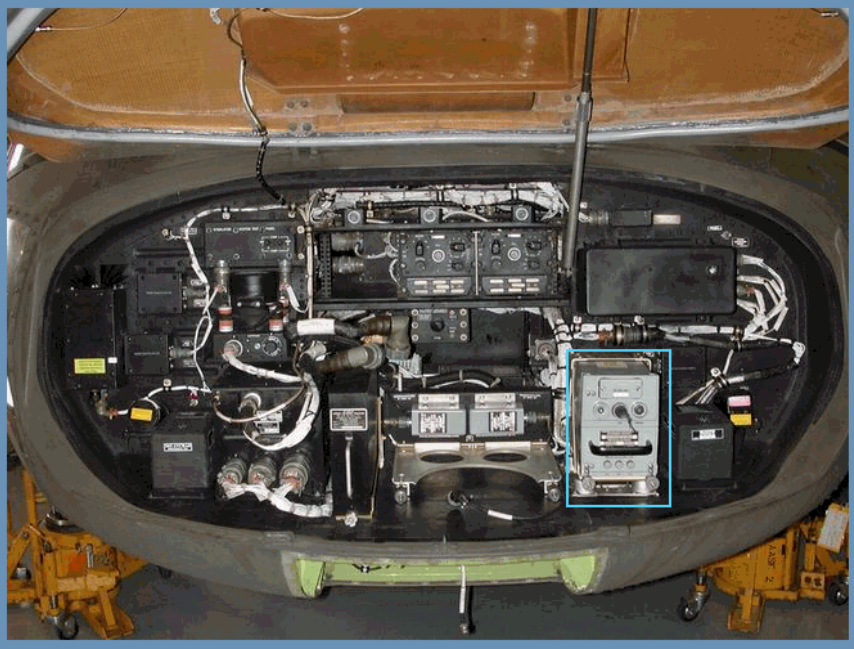
1) The radar receiver/transmitter (r/t), on the lower console.

2) The r/t is a space diversity transponder which receives radio frequency interrogations from the upper and lower antennas.

3) The set functionally interfaces with the pilot altimeter encoder (pilot barometric altimeter), the Intercommunication Set (ICS), the Caution/Advisory Warning System, and a drag beam switch through the audio junction box assembly (junction box).

(b) Transponder Computer (KIT1-C)

Frame #4207 (Transponder Computer (KIT1-C)



1) The transponder computer (t/c) is located in the avionics nose compartment.

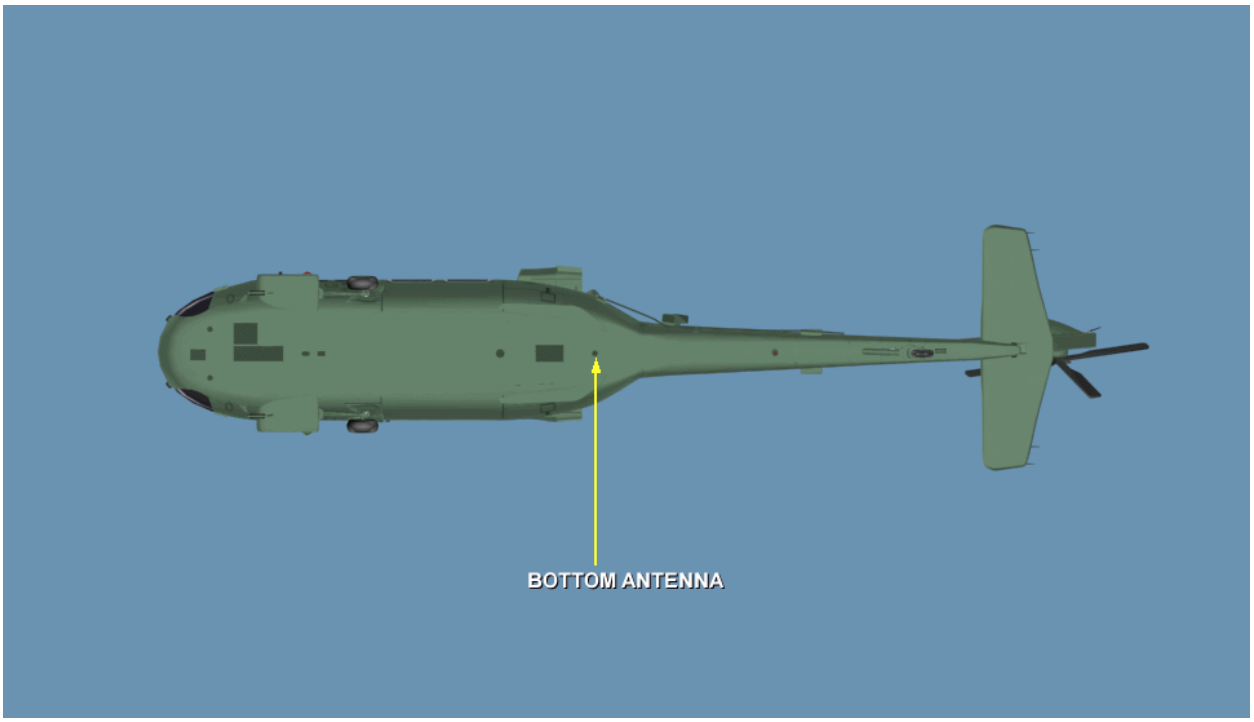
2) The t/c functions only during mode 4 interrogations.

3) Mode 4 interrogations bypass the decoder in the r/t and are supplied directly to the t/c.

4) The t/c decodes the interrogation pulse (challenge video) and generates a coded reply pulse which is routed to the r/t for transmission.

(c) Bottom Antenna

Frame #4210 (Bottom Antenna)



1) Bottom Antenna is located in the rear of the transition section.

2) The Transponder Set receives rf interrogation signals from a challenging station.

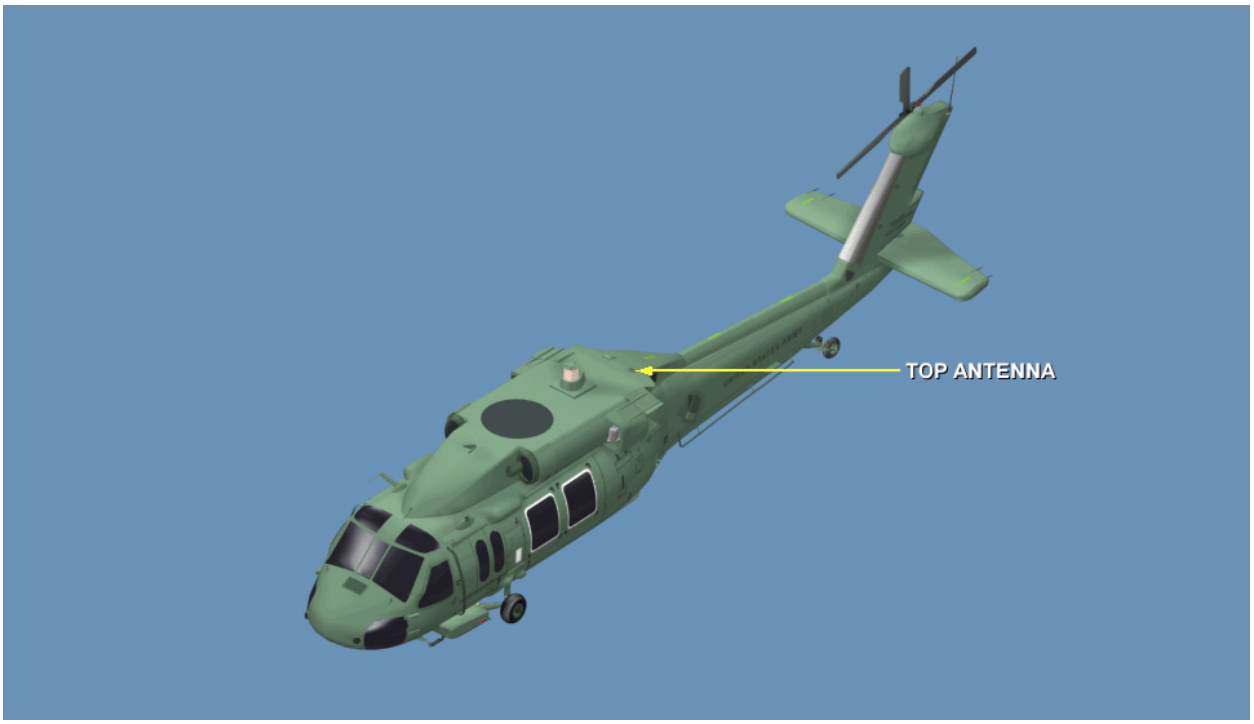
3) The signals are received by the upper and lower antennas and routed to the r/t.

4) The r/t transmits a reply message in the same mode as the interrogation from the challenging station.

5) The reply is automatically routed to the antenna that receives the stronger interrogation signal.

(d) Top Antenna

Frame #4215 (Top Antenna)



1) The top antenna is located aft of the APU compartment.

2) The Transponder Set receives rf interrogation signals from a challenging station.

3) The signals are received by the upper and lower antennas and routed to the r/t.

4) The r/t transmits a reply message in the same mode as the interrogation from the challenging station.

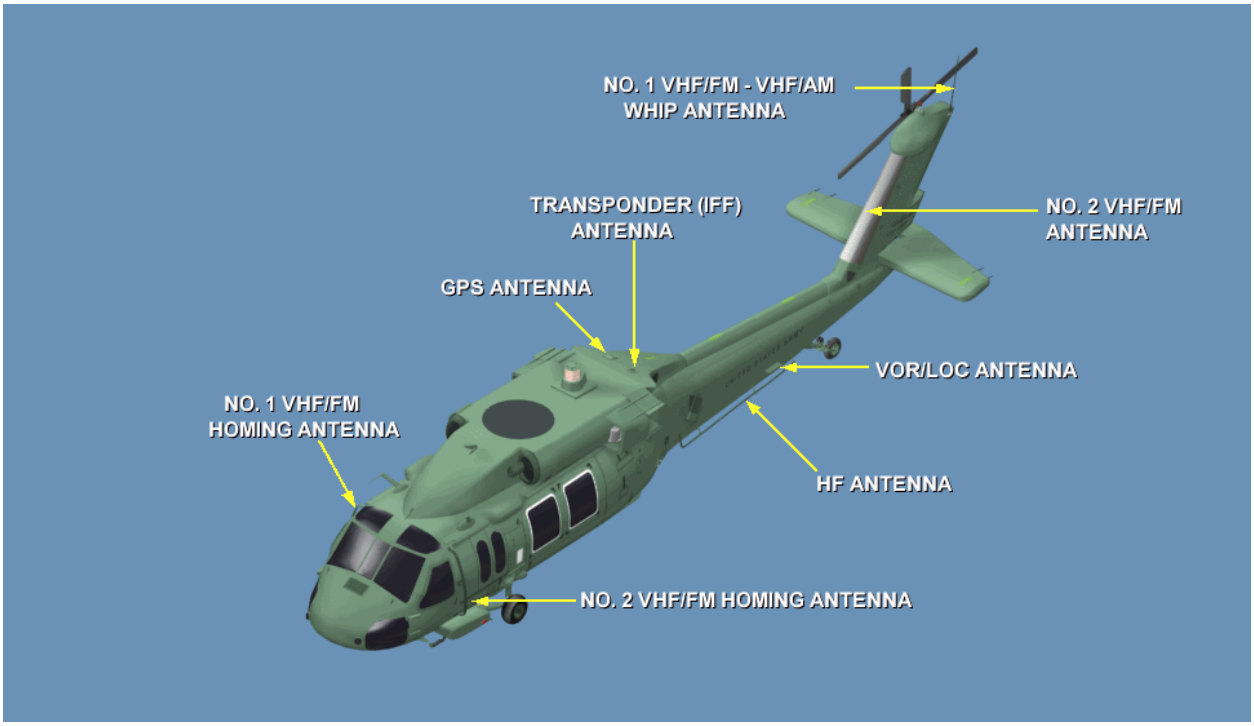
5) The reply is automatically routed to the antenna that receives the stronger interrogation signal.

f. Antenna Locations

Frame #4220 (Antenna Locations)

(1) Antenna Location (TOP)

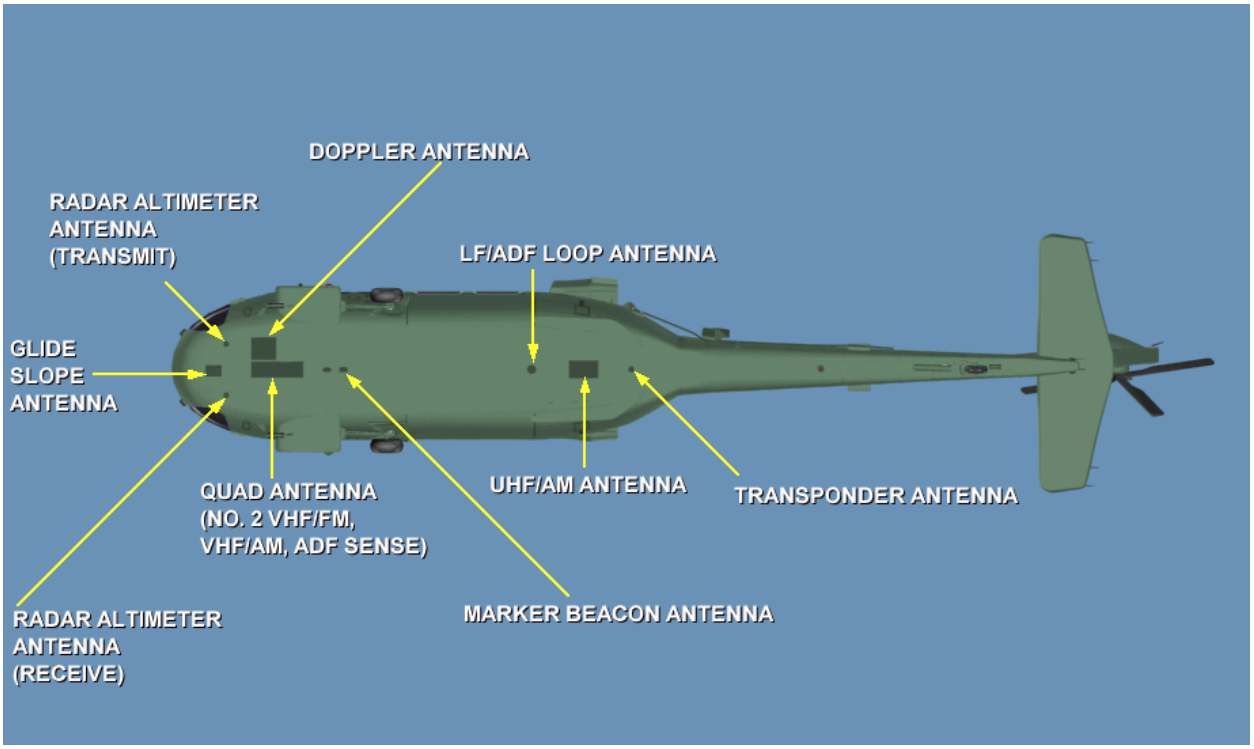
Frame #4221 (Antenna Location (TOP)



(a) This diagram shows the location of all the antennas located on the top of the aircraft that are related to the Navigational and Communication system.

(2) Antenna Location (Bottom)

Frame #4222 (Antenna Location (Bottom)



(a) This diagram shows the location of all the antennas located on the bottom of the aircraft that are related to the Navigational and Communication system.

Check on Learning

1. How many ICS control panels are located throughout the UH-60?

2. What type of radio is the AN/ARC-186 radio set?

3. What type of voice communications does the AN/ARC-164 radio set provide?

4. How many COMSEC amplifiers are installed when 2 radios are installed?

5. Which antenna in the AN/APX-100 Transponder set replies to an interrogation signals?

6. What is not one of the versions of the AN/ARC-164 UHF/AM Radio set?

SECTION VI. -SUMMARY

1. REVIEW/SUMMARIZE:

You have completed the identification of components of the UH-60 navigational system topic.

The key points to remember are:

- There are 5 ICS control Panels: crew chief/right gunner, left gunner, and troop commander, pilot and copilot. The control panels amplify the received audio and apply it to the headsets at stations where the Set reception is selected.
- The Junction Box is located below lower console radios. All intercom and radio transmission/reception goes through the junction box.
- The battery box is located in the pilot seatwell. A memory hold-up battery (7.5 Vdc) is installed externally to retain ECCM memory, presets, and time.
- COMSEC amplifier (COMSEC amp) is located in the nose compartment. One amp for each radio installed.
- The two VHF/FM Homing Antenna is located on each side of the aircraft, aft of the pilot doors.
- The No. 1 Very High Frequency/Frequency Modulation (VHF/FM) (AN/ARC-186 (V)) Radio Set provides two-way FM voice communications on any one of 2,320 channels in the frequency range of 30.00 to 87.975 MHz in units of 25 kHz.
- The Ultra High Frequency/Amplitude Modulation (UHF/AM) (AN/ARC-164 (V) Radio Set provides two-way AM voice communications on any one of 7,000 tunable or 20 preset channels. Three different versions are Standard, Have Quick, Have Quick ll.
- The transponder computer (t/c) is located in the avionics nose compartment. The t/c functions only during mode 4 interrogations.

E. ENABLING LEARNING OBJECTIVE ELO No.5

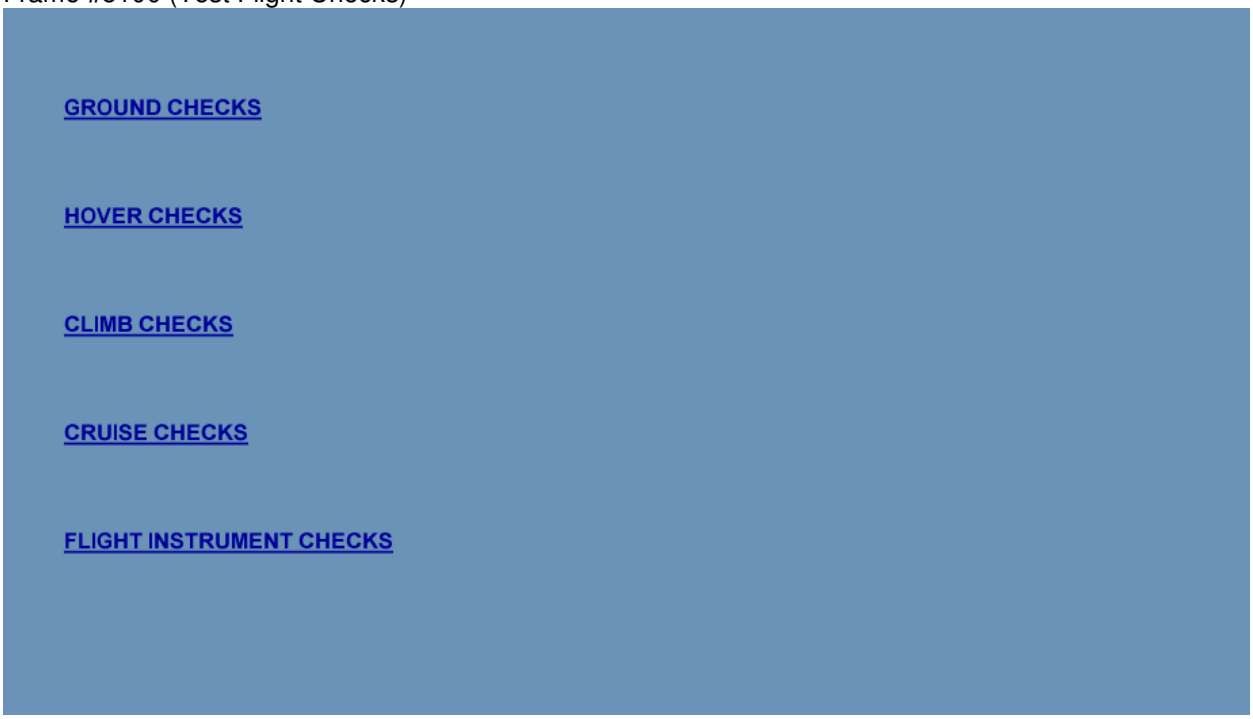
ACTION: Perform and Describe the Communication and Navigational Radio Test Flight checks for the UH-60.

CONDITION: Given TM 1-1520-237-MTF.

STANDARD: IAW TM 1-1520-237-MTF.

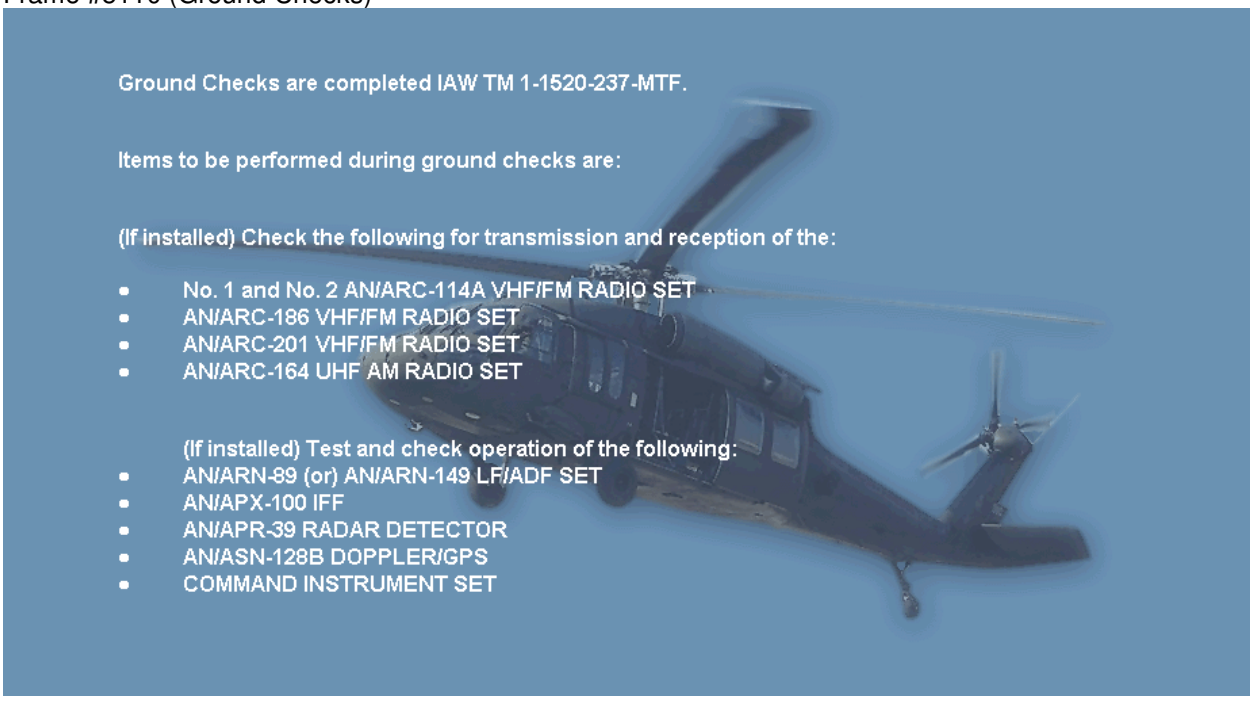
a. Test Flight Checks

Frame #5100 (Test Flight Checks)



(1) Ground Checks

Frame #5110 (Ground Checks)



(a) Ground Checks are completed IAW TM 1-1520-237-MTF.

(b) Items to be performed during ground checks are:

(c) (If installed) Check the following for transmission and reception of the:

1) No. 1 and No. 2 AN/ARC-114A VHF/FM RADIO SET

2) AN/ARC-186 VHF/FM RADIO SET

3) AN/ARC-201 VHF/FM RADIO SET

4) AN/ARC-164 UHF AM RADIO SET

(d) (If installed) Test and check operation of the following:

1) AN/ARN-89 (or) AN/ARN-149 LF/ADF SET

2) AN/APX-100 IFF

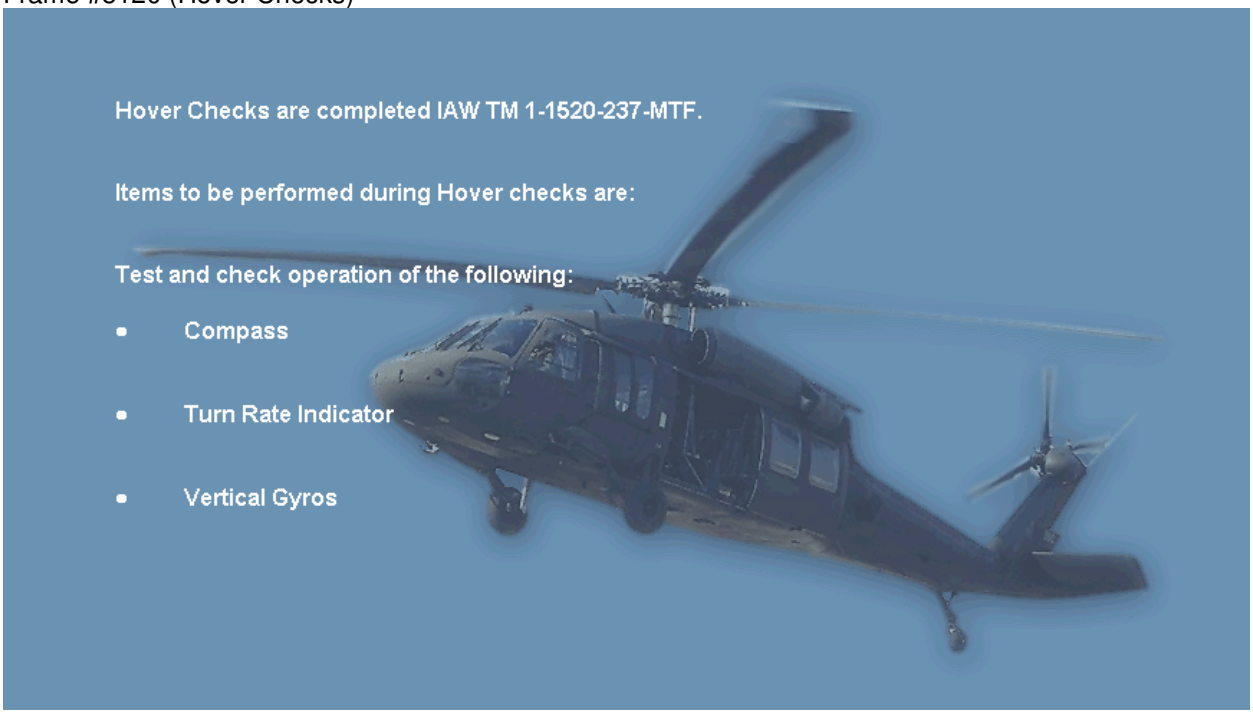
3) AN/APR-39 RADAR DETECTOR

4) AN/ASN-128B DOPPLER/GPS

5) COMMAND INSTRUMENT SET

(2) Hover Checks

Frame #5120 (Hover Checks)



(a) Hover Checks are completed IAW TM 1-1520-237-MTF.

(b) Items to be performed during Hover checks are:

(c) Test and check operation of the following:

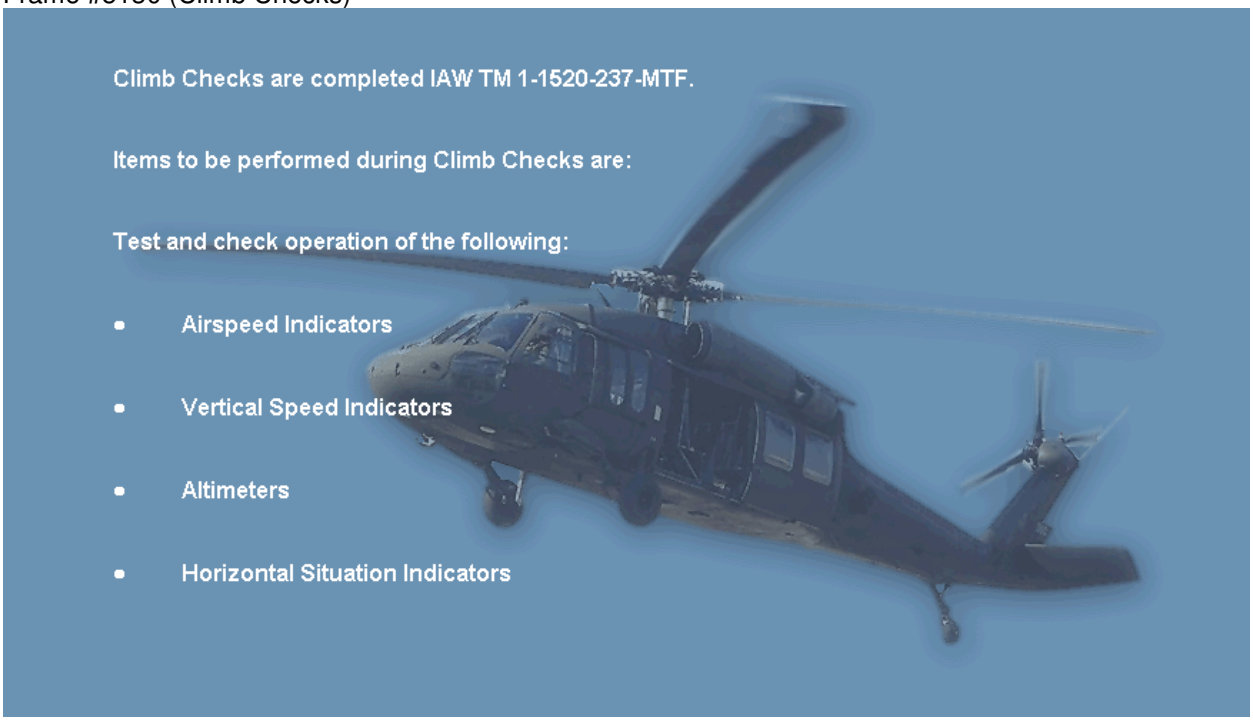
1) Compass

2) Turn Rate Indicator

3) Vertical Gyros

(3) Climb Checks

Frame #5130 (Climb Checks)



(a) Climb Checks are completed IAW TM 1-1520-237-MTF.

(b) Items to be performed during Climb Checks are:

(c) Test and check operation of the following:

1) Airspeed Indicators

2) Vertical Speed Indicators

3) Altimeters

4) Horizontal Situation Indicators

(4) Cruise Checks

Frame #5140 (Cruise Checks)

Cruise Checks are completed IAW TM 1-1520-237-MTF.

Items to be performed during Cruise Checks are:

(If Installed) Test and check operation of the following:

- Airspeed Indicators at 80,100,120,145 Knots (± 5 Knots)
- No. 1 and No. 2 AN/ARC-114A FM Radio Set
- No. 1 and No. 2 AN/ARC-201 VHF/FM Radio Set
- AN/ARC-186 VHF AM/FM Radio Set
- AN/ARN-89/147 LF/ADF
- AN/ARC-164 UHF
- AN/ARN- 123/147 VOR
- AN/APX-100 IFF
- AN/APN-209 RADAR ALTIMETER
- AN/ASN-128B Doppler/GPS
- Command Instrument Set

(a) Cruise Checks are completed IAW TM 1-1520-237-MTF.

(b) Items to be performed during Cruise Checks are:

(c) (If Installed) Test and check operation of the following:

1) Airspeed Indicators at 80,100,120,145 Knots (± 5 Knots)

2) No. 1 and No. 2 AN/ARC-114A FM Radio Set

3) No. 1 and No. 2 AN/ARC-201 VHF/FM Radio Set

4) AN/ARC-186 VHF AM/FM Radio Set

5) AN/ARN-89/147 LF/ADF

6) AN/ARC-164 UHF

7) AN/ARN- 123/147 VOR

8) AN/APX-100 IFF

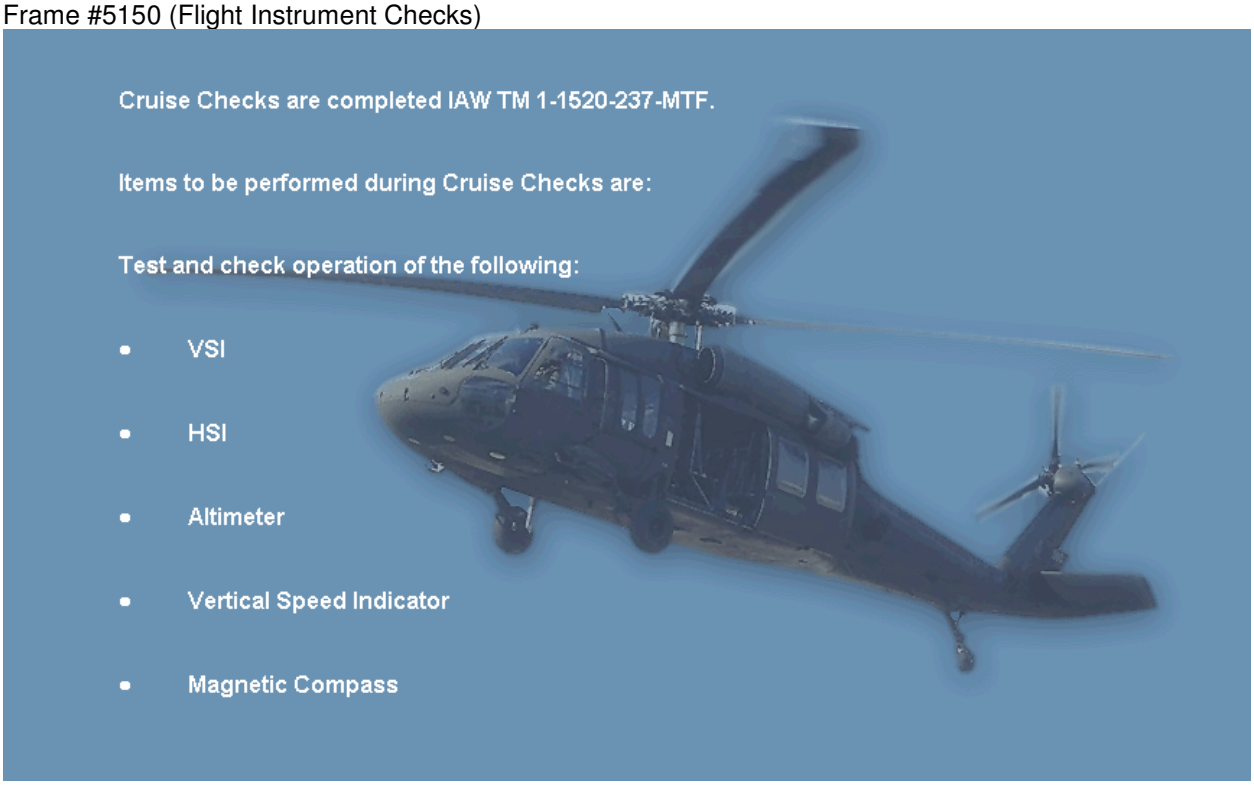
9) AN/APN-209 RADAR ALTIMETER

10) AN/ASN-128B Doppler/GPS

11) Command Instrument Set

(5) Flight Instrument Checks

Frame #5150 (Flight Instrument Checks)



(a) Flight Instrument Checks are completed IAW TM 1-1520-237-MTF.

(b) Items to be performed during Cruise Checks are:

(c) Test and check operation of the following:

1) VSI

2) HSI

3) Altimeter

4) Vertical Speed Indicator

5) Magnetic Compass

CHECK ON LEARNING

1. What manual is used to perform test flight checks?

2. Which is not one of the components that is tested during Hover Checks portion of the Test Flight Checks?

3. What component is not tested during the Cruise Check portion of the Test Flight Checks?

SECTION VII. - SUMMARY

1. REVIEW/SUMMARIZE:

You have completed the description of the Navigational and Communication system performed during Test Flight Checks topic.
The key points to remember are:

- The manual that is used to complete all the checks during the Test Flight Checks is the TM 1-1520-237- MTF.
- During the Hover Check portion of the Test Flight Checks the components that are tested are the: Compass, Turn Rate Indicator, Vertical Gyros.
- During the Climb Checks portion of the Test Flight Checks the components that are tested are the: Airspeed Indicators, Vertical Speed Indicators, Altimeters, Horizontal Situation Indicators.
- During the Cruise Checks portion of the Test Flight Checks the components that are tested are the: Command Instrument Set, Airspeed Indicator, IFF, Radar Altimeter, Doppler GPS, VOR, LF/ADF, VHF AM/FM radio set, VSI, HSI, Barometric Altimeter, Vertical Speed Indicator, and Magnetic Compass.
- During the Cruise Checks portion of the Test Flight Checks, the Airspeed Indicator is checked at 80, 100, 120, and 145 knots ($\pm$ 5 knots).

APPENDIX A

ILLUSTRATION LISTING

FRAME #	FRAME TITLE
0015	MENU
1005	TECHNICAL MANUALS OVERVIEW
1010	TM 1-1500-204-23- (SERIES)
1015	TM 1-1520-237-23 (SERIES)
1020	TM-1-1520-237-23-1
1025	TM 1-1520-237-23-4
1030	TM 11-1520-237-23 (SERIES)
1035	TM 11-1520-237-23-1 (VOLUME 1)
1040	TM 11-1520-237-23-3 (VOLUME 3)
1045	TM 11-1520-237-23-4 (VOLUME 4)
1050	TM 1-1520-237-10
1055	TM 1-1520-237-MTF
2002	Components and Miscellaneous Instruments Menu
2005	Pitot-Satic System
2010	Pitot-Static System Components
2011	Barometric Altimeter
2012	Airspeed Indicator
2013	Vertical Velocity Indicator
2014	Pitot Head And Lines
2015	Pitot-Static System Testing And Troubleshooting
2020	Standby Magnetic Compass
2021	Compass Replacement Criteria
2025	Standby Compass Deviation Card
2026	Preparation For Compass Swing
2027	Compass Swing Procedures
2028	Performing Coefficient A
2029	Performing Coefficient C
2030	Performing Coefficient B
2035	Aircraft Clock
2036	Aircraft Clock
2040	Free Air Temperature (FAT) Gage
3002	Navigational System Menu
3005	Gyro-Magnetic Compass Set (AN/ASN-43)
3010	Induction Compass Transmitter (Flux Valve)
3020	Magnetic Compensator
3030	Compass Set Control
3040	Directional Gyro
3050	Pilot/Copilot Horizontal Situation Indicator (HSI)
3055	Compass Swing Test Data Sheet Uncompensated Swing
3060	Compass Compensation
3063	Conditions
3066	Setup
3069	North/South Correction
3072	East/West Correction
3073	Transmitter Index Error Correction
3078	Compensated Compass Swing
3080	Attitude Indicating Set
3085	Pilot and Copilot Displacement Gyros
3090	Pilot and Copilot HIS/VSI Mode Select Panel

3095	Pilot and Copilot VSI
3100	Rate of Turn Indicating Set
3110	Pilot and Copilot Rate Gyro
3120	Pilot and Copilot Mode Select Panel
3130	Pilot and Copilot VSI
3200	Command Instrument Set
3210	CIS Processor
3220	CIS Mode Select Panel
3230	Pilot and Copilot HSI
3231	Pilot and Copilot VSI
3240	Pilot and Copilot Cyclic Go-Around Buttons
3300	Civil Navigation Set (AN/ARN-123)
3310	Radio Receiver
3330	Receiver Control Unit
3340	Marker Beacon Antenna
3350	Glide Slope Antenna
3360	VOC/LOC Antenna
3370	Pilot And Copilot HSI/VSI Mode Select Panel
3380	Pilot and Copilot VSI
3390	Pilot and Copilot HSI
3400	Audio Junction Box
3500	LF/ADF Set (AN/ARN-89)
3510	Radio Receiver
3520	Radio Set Control
3530	Adjustable Impedance Matching Amplifier
3540	Directional Loop Antenna
3550	Nondirection Sense Antenna
3600	Doppler/GPS Navigation Set (AN/ASN-128B)
3610	Central Display Unit (CDU)
3620	Signal Data Converter (SDC)
3630	Receiver/Transmitter Antenna (RTA)
3700	Radar Altimeter Set (AN/APN-209)
3710	Copilot Receiver/Transmitter Height Indicator (HI) and Pilot Remote Height Indicator (HI)
3720	Transmit Antenna
3730	Receive Antenna
4100	Intercommunication Set Component Menu
4105	Intercommunications Set (ICS) Control Panels
4110	ICS Transmission Keys
4115	Audio Junction Box
4120	Audio Transformers
4125	No. 1 and No. 2 VHF/FM RADIO SET AN/ARC-201
4130	Radio Set Control Panel
4135	KY-58 Control Panel
4140	Receiver/Transmitter
4145	Battery Box
4150	COMSEC Amplifier
4155	COMSEC Loop
4160	IFM RF Amplifier
4165	Low Pass Filter
4170	Whip Antenna
4175	FM Homing Antenna
4180	No. 2 FM Antenna
4185	No.1 and No. 2 VHF/FM RADIO SET (AN/ARC-186)
4195	UHF/AM RADIO SET (AN/ARC-164)
4200	Transponder Set (AN/APX-100)
4205	Radar Receiver/Transmitter

APPENDIX B

TEST AND TEST SOLUTIONS

1. This appendix is only used when the test and solutions are internal to the POI file.

2. When the test and solutions are internal to the POI file, then the POI file becomes a FOR OFFICIAL USE ONLY document.