



# **UH60A SYSTEMS ACADEMIC SUPPLEMENT** **AND PRACTICAL EXERCISE**

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## **INTRODUCTION:**

1. The UH-60 (BLACK HAWK) is a \_\_\_\_\_, single rotor, semi-monocoque stressed skin constructed fuselage, rotary wing helicopter.
2. The \_\_\_\_\_ is a fully articulated, four blade, main rotor head, consisting of four subsystems: main rotor blades, hub, flight controls, and the bifilar vibration absorber.
3. A rigid crossbeam, two blade, four paddle tail rotor system provides \_\_\_\_\_.
4. The helicopter has a conventional, \_\_\_\_\_ landing gear consisting of two main gear assemblies and a tail wheel assembly.
5. The 20 degree canted tail rotor also provides \_\_\_\_\_ of the total lifting force in a hover.
6. Design weight is \_\_\_\_\_.
7. An \_\_\_\_\_ is located in the nose of the aircraft.
8. The deck load limit is \_\_\_\_\_ per square foot.
9. Maximum capacity for each storage compartment is \_\_\_\_\_.
10. The hydraulic accumulator and hand pump in the aft midsection cabin ceiling provide the hydraulic pressure for driving the \_\_\_\_\_.
11. The tail wheel can be locked in a trail position by a TAIL WHEEL switch in the cockpit lower console miscellaneous switch panel indicating \_\_\_\_\_.
12. A high-rate discharge fire extinguishing system provides a two-shot, main and reserve (2 fire bottles) capability to either main engine compartment or \_\_\_\_\_ compartment.
13. Each engine platform is capable of supporting a static weight of \_\_\_\_\_ pounds.
14. Two \_\_\_\_\_, one in front of each pilot on the glare shield contain the following capsules labeled: MASTER CAUTION PRESS TO RESET (amber), #1 ENG OUT, #2 ENG OUT, FIRE, and LOW ROTOR RPM.
15. The PDU displays the engine power turbine speed (% RPM 1 and 2), rotor speed (% RPM R), and \_\_\_\_\_.
16. Each accessory module provides mounting and drive for an \_\_\_\_\_ and a hydraulic pump package.
17. A drag beam switch (WOW, weight on wheels) is located on the airframe at the \_\_\_\_\_ attaching point.
18. When releasing the parking brakes with the main rotor turning, ensure that pressure is applied to \_\_\_\_\_ pedals.
19. Emergency Exits are displayed in the operator's manual, Chapter 9, Fig \_\_\_\_\_.

## **ENGINE:**

20. TGT and \_\_\_\_\_ can be the best cockpit instruments used for identifying, and reacting to engine malfunctions.
21. A gearbox that mechanically drives engine accessory components, every \_\_\_\_ component is driven relative to NG speed
22. Keep in mind that operational knowledge of the engine and its instruments revolves around the understanding of the two main operational sections of \_\_\_\_\_, which operate within the four modules.
23. Power Turbine Speed (Np) drives the \_\_\_\_\_.
24. The oil temperature detector, or sensor, transmits oil temperature to the cockpit (CDU via SDC), the "Eng. oil temp" caution light illuminates at \_\_\_\_\_.
25. The alternator forwards an Ng signal to the cockpit (PDU via SDC), and supplies electrical power to the \_\_\_\_\_.
26. The speed switch commands the starter valve to open until the Ng speed reaches a minimum of 52% Ng. \_\_\_\_\_, the start valve will close extinguishing the starter caution light.
27. When engine is controlled with the ENG POWER CONT lever in \_\_\_\_\_, engine response is much faster and TGT limiting system is inoperative. Care must be taken not to exceed \_\_\_\_\_ in operating range.
28. Pulling \_\_\_\_\_ on the PCL activates the abort start switch.
29. To accomplish a cross bleed start, the running engine should be at 90% Ng with the RPMR at 100%, and the engine anti-ice advisory light \_\_\_\_\_.
30. Minimum oil pressure is 20 psi below \_\_\_\_\_ or 35 psi above \_\_\_\_\_.
31. The alternator powers all essential \_\_\_\_\_ functions.
32. When alternator power is absent (alternator failure) all ECU circuits except \_\_\_\_\_ protection and the history data feed are rendered inoperative.
33. Pilot authority to adjust the Np reference is limited to \_\_\_\_\_ rpm 1 or 2, with the pilot side switch having authority should both switches be actuated at the same time.
34. The Np O/S protection activates when the Np speed exceeds 22,200 RPM (\_\_\_\_\_).
35. The \_\_\_\_\_ mechanically positions Variable Geometry (VG) linkage.
36. If an ECU malfunction causes an uncommanded power reduction as low as idle (low side failure), the pilot can reclaim lost power through \_\_\_\_\_.
37. The POU has \_\_\_\_ functions: sequences start fuel to two primer nozzles, sequences main fuel to twelve main fuel injectors, purges start and main fuel manifolds and nozzles/injectors, and fuel flow cut back to provide Np O/S protection IAW the ECU input.

38. The \_\_\_\_\_ ANTI-ICE ON light is illuminated via a thermal switch inside the inlet when the inlet temperature reaches 93°C.

39. The Anti-Ice Start Bleed Valve (AISBV) in the open position will make the \_\_\_\_\_ advisory appear.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **FLIGHT CONTROLS AND HYDRUALICS:**

40. The \_\_\_\_\_ combines, sums, and couples cyclic, collective, and yaw inputs.

41. The 4 functions of MMU are \_\_\_\_\_.

42. The first or second stage primary servo pressure caution lights will appear if there is a \_\_\_\_\_.

43. When pressure drops below \_\_\_\_\_ the switch illuminates the SAS OFF caution light.

44. The tail rotor servo is a two-stage component, and \_\_\_\_\_ is pressurized at any one time.

45. In the event both cables break, this spring places the pilot valve in a position that gives a positive pitch of \_\_\_\_\_ in the tail rotor if there is a pressurized tail rotor servo.

46. The two micro switches illuminate the TAIL ROTOR QUADRANT caution light if one of the \_\_\_\_\_ breaks.

47. Under normal operation, the first stage tail rotor servo is pressurized by the first stage hydraulic system, and the backup pump can pressurize it, when the #1 pump fails. The second stage tail rotor servo is pressurized by the \_\_\_\_\_.

48. The Low-level sensing switch will close the circuit and illuminate the #1, #2 and/or BU PUMP \_\_\_\_\_ light on the caution/advisory panel (60% fluid remaining).

49. A Backup Pump thermal switch is incorporated that limits the motor's ground operation to  $165 \pm 5^\circ \text{C}$ . The switch is \_\_\_\_\_ in flight by the drag beam switch.

50. The \_\_\_\_\_ valve is electrically connected to the backup pump, and its purpose is to unload the AC motor on the backup pump during the start cycle.

51. The \_\_\_\_\_ shuts off flow to the accumulator if flow rate exceeds 1.5 gpm.

52. The \_\_\_\_\_ will recharge the accumulator regardless of what position the backup pump switch is in.

53. The \_\_\_\_\_ in the transfer module will isolate a leaking #1 or #2 Pump.

54. Electrical interlock ensures both \_\_\_\_\_ can't isolate both PRI SVO stages.

55. The Backup Pump motor is a \_\_\_\_\_.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **AFCS**

56. Purpose of the \_\_\_\_\_ is to enhance the stability and handling qualities of the helicopter.

57. The SAS enhances \_\_\_\_\_ stability in the pitch, roll, and yaw axes.

58. Two \_\_\_\_\_ receive airspeed, collective stick position, pitch rate, and lateral acceleration information to program the stabilator through the dual electric \_\_\_\_\_.

59. The test button is operational at airspeeds below \_\_\_\_ knots and is used to ground check the \_\_\_\_\_ system.

60. The #1 Stab Actuator can be moved with battery power via the \_\_\_\_\_.

61. Both SAS together have 10% control authority, a single SAS has \_\_\_\_%.

62. The yaw trim actuator and electronic collective to airspeed to yaw coupling has maximum effect below \_\_\_\_ knots, no effect above \_\_\_\_ knots.

63. Digital AFCS, \_\_\_\_\_, work in the Pitch, Roll and Yaw axes.

64. FPS will attempt to hold attitude in pitch and roll, also heading in yaw above and below 60 knots, but above 60 knots in the pitch and yaw FPS also provides \_\_\_\_\_.

65. Stabilator automatic function provides Streamlining, Collective compensation, Angle of incidence (variable), \_\_\_\_\_, and Pitch rate feedback.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **CIS/NAV**

66. When Go-Around is active the \_\_\_\_\_ immediately provides a collective position indication and a roll command indication which, when followed, results in a  $500 \pm 50$  feet-per-minute rate-of-climb at a zero degree bank angle. The Go-Around (GA) advisory light illuminates whenever the GA switch on the pilot or copilot \_\_\_\_\_ is pressed.

67. The CDP and CDB scale represents right or left of course. Each dot from center (on course) is  $1.25^\circ$  for \_\_\_\_\_ or  $5^\circ$  for \_\_\_\_\_.

68. At the top right of the \_\_\_\_\_ is the Attitude warning flag marked ATT, it appears when a power failure or low RPM occurs in the selected vertical gyro.

69. Both pilot and copilot CRS HDG switches are take only will display \_\_\_\_\_ information at all times.

70. Rule #3 is the CDB referencing D/GPS; VOR; LOC. Rule #4, CDP adds \_\_\_\_\_, to rule 3. Rule # 5, RCB adds \_\_\_\_\_ to rule 4.

71. Altitude hold will engage at the altitude the ALT switch is pressed provided the rate of climb or descent does not exceed \_\_\_\_ feet per minute, altitude is between -1000 feet and +10,000 feet, and airspeed is between \_\_\_\_\_ KIAS.

72. The \_\_\_\_\_ provides processed pitch commands to maintain airspeed in the ILS NAV mode and the GA mode.

73. When the helicopter is within the capture zone, the CISP commands the heading mode to automatically drop out, and commands a \_\_\_\_\_ intercept to the selected NAV course.

## **ELECTRICAL**

74. If the GEN BRG caution light stays on longer than \_\_\_\_\_, make an entry on the DA Form 2408-13-1.

75. The \_\_\_\_\_'s purpose is to control voltage output and provide circuit protection.

76. The APU GEN can provide power to all equipment on board the aircraft except, with the \_\_\_\_\_ on line at the same time.

77. APU GEN ON advises you that the APU generator is the \_\_\_\_\_ of AC power at the AC Primary Busses.

78. GCU's under-frequency protection is disabled in flight by the \_\_\_\_\_.

79. If aircraft does not receive AC power once the external power switch is in the ON position, move the switch to \_\_\_\_\_ then ON, (resetting the external power monitor panel)

80. In acft with SLAB battery installed, the battery low sensing relay will illuminate the "BATTERY LOW CHARGE" light at \_\_\_\_\_.

81. If you have both \_\_\_\_\_ caution lights illuminated you lose converted DC power to the #1 and #2 DC Primary Busses.

82. \_\_\_\_\_  
are the six lights that appear when the battery is turned on.

83. The \_\_\_\_\_ convert 3 phase AC to 200 amp/28V DC.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

## **DOPPLER/GPS**

84. Up to \_\_\_\_ destinations (waypoints) can be entered into the CDU. Waypoints are numbered 00 to \_\_\_\_.
85. Waypoints 70 to 89, cannot be changed via the CDU keyboard and must be loaded from a \_\_\_\_\_ only, however once loaded they are used for navigation. Waypoints \_\_\_\_\_ are reserved for Target Store Waypoints, but can also be used as standard waypoints.
86. DISPLAY switch XTK/TKE KEY and DIST/BRG TIME allows for selection of \_\_\_\_\_ by a direct entry of two-digit destination number.
87. Route Sequence Submodes (Consecutive and Random) of Navigation information will be displayed to the waypoint next on the sequence list until \_\_\_\_\_ before over flying the waypoint.
88. The \_\_\_\_\_ switch on the CDU must be placed to the TEST position for the malfunction code to be displayed.
89. For momentary failures the operator can extinguish the \_\_\_\_\_ light by cycling the mode switch OFF then return to the Navigation Mode.
90. The \_\_\_\_ mode should only be used if the aircraft is operating in an area susceptible to GPS signal jamming.
91. As an aid to maintaining course, set the DISPLAY switch to the XTK/TKE position and steer the aircraft to keep the Track Angle Error (TKE) at \_\_\_\_\_.
92. The \_\_\_\_\_ will take approximately 15 seconds to test the Doppler and up to 2 minutes for GPS.

## **FUEL:**

93. Maximum fuel pressure from the service vehicle is \_\_\_\_\_, at 300 gallons per minute.
94. \_\_\_\_\_ is controlled by either incoming fuel pressure or back pressure (high-level, float-type, shutoff valves) acting on the backside of the diaphragm.
95. When approximately \_\_\_\_\_ in the fuel cell a #1 FUEL LOW or #2 FUEL LOW caution light will flash in unison with the master caution light.
96. The submerged boost pump \_\_\_\_\_, near each control switch on the panel, receives 28 VDC from the battery bus indicating proper pump pressure and operation.
97. The pump's inlet side creates a \_\_\_\_\_ pressure -3 to -6, which pulls fuel from the fuel cell up to the pump and is driven by Ng in proportion to Ng speeds. The pump's outlet side creates a positive pressure \_\_\_\_\_, which supplies fuel to the HMU.
98. The HMU pump is located inside the HMU, which is mounted to the accessory gear box and is gear driven by the \_\_\_\_\_ that is variable in speed.
99. A fuel pressure switch, which is located on the \_\_\_\_\_, monitors pump output and illuminates the fuel pressure caution light if fuel pressure drops below 9 psi.

100. The PRIME BOOST PUMP ON advisory will appear when No. 1 or No. 2 engine starter system is engaged and will electrically open or close the prime shutoff valves and supply electrical power to the prime boost pump from the 28 V dc battery bus. Referred to as \_\_\_\_\_.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **AUX EQUIPMENT:**

101. During APU starts using battery power, or when the APU GEN is the sole source of AC power, if the fire extinguisher is required, \_\_\_\_\_ must be used.

102. The APU fail caution light will be on any time the APU automatically shuts down. The \_\_\_\_\_ of the ESU shall be used to troubleshoot APU malfunctions.

103. The AIR SOURCE HEAT/START switch must be set to the pneumatic source \_\_\_\_\_ to use bleed air from the engines.

104. Operation of the heater will reduce the maximum torque available by \_\_\_\_\_ with the ENG selected as the pneumatic source.

105. The \_\_\_\_\_ are solid-state photoconductive cells that provide continuous volume optical surveillance of infrared radiation in the monitored areas.

106. At airspeeds greater than \_\_\_\_\_ during periods of reduced rain intensity the windshield wipers may slow noticeably. If this occurs, wipers must be \_\_\_\_\_ immediately to avoid permanent wiper motor failure.

107. With the \_\_\_\_\_ as the only source of electrical power the backup hydraulic pump has priority over the windshield anti-ice and cannot be used simultaneously.

108. The Cargo Hook system incorporates three (3) modes of load release \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_.

109. The HOOK ARMED Advisory indicates system ready for \_\_\_\_\_ mode.

110. Current sensors in the circuits sense the current flow and keep the caution lights marked LFT PITOT HEAT and RT PITOT HEAT turned off. If a \_\_\_\_\_, the current sensor will detect no current flow to that circuit and turn on the caution light.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **POWERTRAIN AND ROTORS:**

111. The transmission is limited to \_\_\_\_\_, whichever occurs first.

112. The \_\_\_\_\_ sensor is a magnetic pickup sensor located on the aft side of the right accessory module.

113. If transmission oil pressure drops to a minimum pressure of \_\_\_\_\_, contacts will close and complete the electrical circuit to the caution light.
114. A caution light illuminates when transmission oil temperature exceeds \_\_\_\_\_.
115. This 30-second delay fuse prevents illumination of the caution light if the \_\_\_\_\_ cannot burn off the metal buildup within the time limit.
116. INT XMSN OIL TEMP/TAIL XMSN OIL TEMP, will illuminate any time oil temperature within the gearbox exceeds \_\_\_\_\_, all \_\_\_\_\_ is also deactivated at that temperature.
117. The operator's manual states max wind speed for rotor start or stop is \_\_\_\_\_.
118. The operator's manual states prior to gust lock operations, all \_\_\_\_\_ shall be removed, and operations will be \_\_\_\_\_ at idle.
119. A droop stop fails to seat during shutdown, you accelerate RPMR above \_\_\_\_\_ and displace the cyclic. The droop remains unseated, clear rotor area, cyclic neutral and complete a \_\_\_\_\_.
120. The operator's manual states steady state XMSN oil pressure should be \_\_\_\_\_, and sudden drops of more than \_\_\_\_\_ requires a write up.

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise.

### **MALFUNCTION ANALYSIS:**

NOTE: Refer to the Malfunction Analysis Study Guide for EP practical exercise. There are numerous Emergency Procedures that will be evaluated by both end of phase / module examinations. It is **critical** that the student learn and understand the systems and associated indications during a system failure. The EP Study Guide provided to you is an excellent tool to ensure the student is familiar with the indications as they will appear on the exam.

## **ANSWERS:**

1. twin turbine engine
2. main rotor
3. anti-torque action and directional control
4. nonretractable
5. 2.5%
6. 16,825 lbs
7. avionics compartment
8. 300 pounds
9. 125 pounds
10. APU starter
11. LOCK or UNLK
12. APU
13. 400
14. master warning panels
15. torque (% TRQ 1 and 2)
16. electrical generator
17. left drag beam
18. both
19. 9-1
20. RPMR
21. AGB
22. Ng and Np
23. main rotor
24. 150° C
25. engine ignition and Electrical Control Unit (ECU)
26. Between 52 - 65% Ng
27. LOCKOUT, TGT limits and keeping %RPM R and %RPM 1 and 2
28. downward
29. off
30. 90% Ng, 90% Ng
31. engine
32. Np Over Speed
33. 96-100%
34. (106 ±1 percent)
35. HMU
36. ECU lockout
37. four
38. ENG INLET
39. ENG ANTI-ICE ON
40. mechanical mixing unit
41. Coll to P,R,Y and Yaw to P
42. loss of pressure
43. 2000 psi
44. one stage
45. 10.5°
46. tail rotor cables
47. backup pump
48. RSVR LOW
49. disabled

## **ANSWERS (cont):**

50. depressurizing
51. velocity fuse
52. backup pump
53. transfer valve
54. pilots
55. 115-volt, 3-phase, 12 3/4-horsepower, AC motor
56. AFCS
57. dynamic
58. stabilator amplifiers, actuators
59. 60, fault monitor
60. DC ESS BUS
61. 5
62. 40, 100
63. SAS2 and FPS
64. Airspeed Hold and Turn Coordination
65. Lateral to sideslip
66. CISP, cyclic stick
67. Localizer (ILS), VOR
68. VSI
69. identical
70. FMH, HDG
71. 200, 70 and 150
72. Pitch Command Bar
73. 45°
74. one minute
75. GCU
76. Backup Pump and Windshield A/I
77. sole source
78. WOW switch
79. RESET
80. 23 volts DC
81. #1 CONV and #2 CONV
82. #1 & #2 CONV, AC ESS BUS OFF, BOOST, SAS, STABILATOR
83. Converters
84. 100, 99
85. data loader, 90 to 99
86. fly to destination
87. approximately ten seconds
88. MODE
89. MAL
90. "Y"
91. zero
92. self-test
93. 55 psi
94. The Refuel Valve
95. 172 pounds of fuel remain
96. green advisory light
97. negative, 45-90
98. Ng

**ANSWERS (cont):**

- 99. output side of each pump
- 100. Auto-Prime
- 101. FIRE EXT RESERVE
- 102. BITE indications
- 103. ENG
- 104. 4%
- 105. fire detectors
- 106. 120 KIAS, parked
- 107. APU generator
- 108. Normal, Manual & Emergency
- 109. Normal
- 110. (single) heating element fails
- 111. RPM and torque
- 112. main rotor speed
- 113.  $14 \pm 2$  psi
- 114. 120°C
- 115. fuzz burner
- 116. 140°C, fuzz burner
- 117. 45 KTS
- 118. rotor tie downs, single engine
- 119. 75%, normal shutdown
- 120. 45-55 psi, 10 psi