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Manager, Flight Test & Human Factors Branch, AIR-710  
Federal Aviation Administration

, FTE, AIR-713 for,

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**SECTION 1**

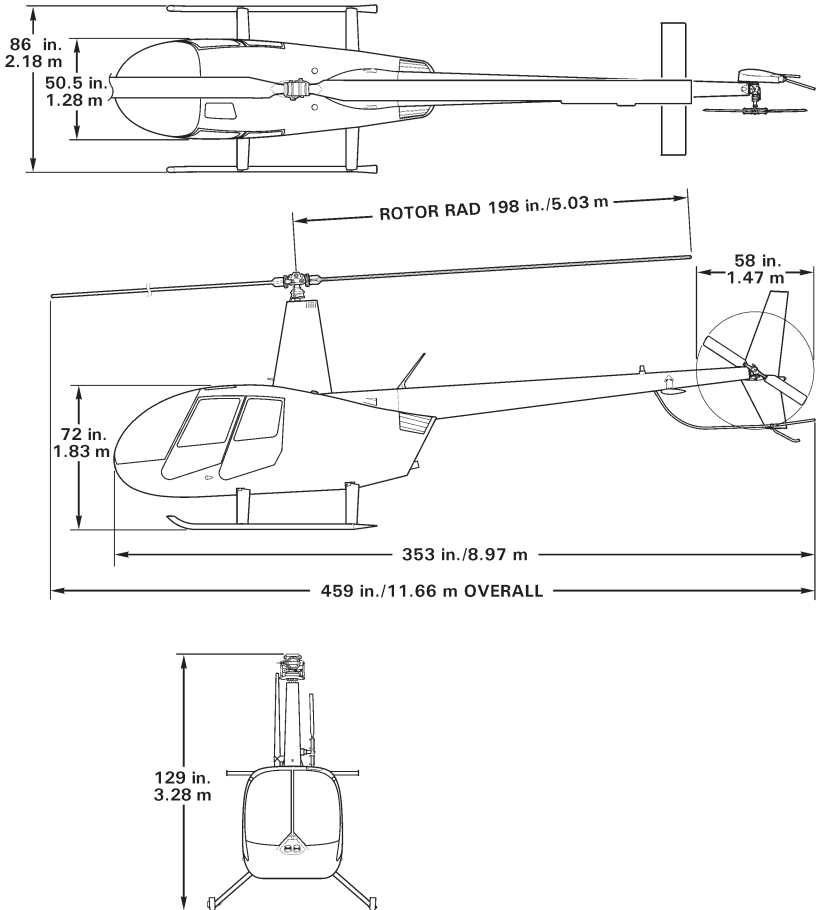
**GENERAL**

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**EXTERNAL DIMENSIONS**



**R44 EXTERNAL DIMENSIONS  
(LATER AIRCRAFT SHOWN)**

**DESCRIPTIVE DATA**

**MAIN ROTOR**

Articulation	Free to teeter and cone, rigid inplane
Number of Blades	2
Diameter	33 feet
Blade Chord	10.0 inches inboard, 10.6 inches outboard
Blade Twist	-6 Degrees
Tip Speed at 102% RPM	705 feet per second

**TAIL ROTOR**

Articulation	Free to teeter, rigid inplane
Number of Blades	2
Diameter	58 inches
Blade Chord	5.1 inches (constant)
Blade Twist	0
Precone Angle	1 Degree
Tip Speed at 102% RPM	614 feet per second

**DRIVE SYSTEM**

Engine to Upper Sheave:	Four double Vee-belts with 0.778:1 speed reducing ratio
Upper Sheave to Drive Line:	Sprag-type overrunning clutch
Drive Line to Main Rotor:	Spiral-bevel gears with 11:57 speed reducing ratio
Drive Line to Tail Rotor:	Spiral-bevel gears with 31:27 speed increasing ratio

**FLIGHT AND MANEUVER LIMITATIONS**

Aerobatic flight prohibited.

***CAUTION***

Abrupt control inputs may produce high fatigue stresses and cause catastrophic failure of a critical component.

Low-G cyclic pushovers prohibited.

***CAUTION***

A pushover (forward cyclic maneuver) performed from level flight or following a pull-up causes a low-G (near weightless) condition which can result in catastrophic loss of lateral control. To eliminate a low-G condition, immediately apply gentle aft cyclic. Should a roll commence during a low-G condition, apply gentle aft cyclic to reload rotor before applying lateral cyclic to stop roll.

Flight prohibited with governor selected off, with exceptions for in-flight system malfunction or emergency procedures training.

Flight in known icing conditions prohibited.

Maximum operating density altitude 14,000 feet.

Maximum operating altitude 9000 feet AGL to allow landing within 5 minutes in case of fire.

Alternator, RPM governor, low rotor RPM warning system, OAT gage, and hydraulic control system must be operational for dispatch.

Minimum crew is one pilot in the right front seat. A flight instructor may act as pilot in command from the left front seat. Solo flight from right seat only.

Forward left seat belt must be buckled.

Operation up to 100 KIAS approved with any combination of cabin doors removed. All seat belts must be buckled and loose items in cabin must be properly secured during doors-off flight.

A functioning headset must be worn by each pilot.

**KINDS OF OPERATION LIMITATIONS**

VFR day and night operations are approved.

VFR operation at night is permitted only when landing, navigation, instrument, and anti-collision lights are operational. Orientation during night flight must be maintained by visual reference to ground objects illuminated solely by lights on the ground or adequate celestial illumination.

Note: There may be additional requirements in countries outside the United States.

**FUEL LIMITATIONS**

**APPROVED FUEL GRADES**

<b>Grade</b>	<b>Color</b>	<b>Specification</b>
100	Green	ASTM D910
100LL	Blue	
100VLL	Blue	
UL 91	Clear to Yellow (no dye)	ASTM D7547
UL 94		
HJELMCO 91/96 UL	Clear to Yellow (no dye)	Hjelmco Oil, Inc. Sollentuna, Sweden
91	Yellow	TU 38.5901481-96 Ukrainian National Standard
B91/115	Green	GOST 1012-72 Russian National Standard
B95/130	Amber	



**NOISE CHARACTERISTICS**

The following noise levels comply with 14 CFR Part 36, Appendix J and ICAO Annex 16, Chapter 11 noise requirements and were obtained from FAA-approved data from actual noise tests.

Model: R44  
 Engine: Lycoming O-540-F1B5  
 Gross Weight: 2400 lb (1089 kg)

Configuration		V <sub>H</sub> KTAS	Flyover Sound Exposure Level dB(A)
Earlier Version	Large Muffler	108	78.9
	Small Muffler		81.9
Later Version	Large Muffler	107	81.0

**Notes:**

1. Configurations are:

Earlier version — Horizontal Stabilizer is mounted adjacent to tail gearbox.

Later version — Horizontal Stabilizer is mounted under tailcone forward of tail rotor.

2. Large muffler is P/N C169-35 or -36

Small muffler is P/N C169-1 or -3

3. Later version with small muffler is not an approved configuration.

These noise levels meet the requirements for a Stage 3 helicopter as defined in 14 CFR Part 36.

**NOTE**

No determination has been made by the Federal Aviation Administration that the noise levels of this aircraft are or should be acceptable or unacceptable for operation at, into, or out of any airport.

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**LOADING INSTRUCTIONS**

The following table may be used when calculating loaded helicopter weight and CG position.

COMMON ITEM WEIGHT & CG

Item	Weight (lb)	Longitudinal arm (in.)	Lateral arm (in.) (+ = right side)
Pilot (right forward seat)		49.5 *	+ 12.2
Left forward passenger		49.5 *	- 10.4
Baggage under forward seats		44.0	± 11.5
Aft passengers and baggage under aft seats		79.5	± 12.2
Main fuel* *		106.0	- 13.5
Aux fuel* *		102.0	+ 13.0
Forward doors	7.5 each	49.4	± 24.0
Aft doors	7.0 each	75.4	± 23.0
Removable controls (cyclic, collective, pedals)	2.0	31.0	- 13.0
Items on accessory mount bars		25.0	± 14.0

\* If additional backrest cushion is used, subtract thickness of compressed cushion.

\*\* A longitudinal arm of 104.5 in. may be used for combined main and aux fuel.

**LOADING INSTRUCTIONS (cont'd)**

The following sample calculation demonstrates how to determine loaded helicopter weight and center of gravity. A worksheet is provided on the page following the sample calculation for a weight and balance calculation for your helicopter. Calculated weight and balance must be compared with the CG limits given in Section 2 to determine safe loading. Both takeoff and empty fuel conditions must be within limits.

Lateral CG usually falls well within limits for conventional loadings. If an unusual lateral installation or loading occurs, lateral CG should be checked against the CG limits given in Section 2. The lateral reference datum is the aircraft centerline with items to the right positive and items to the left negative.

**LOADING INSTRUCTIONS (cont'd)**

**SAMPLE LOADING CALCULATION**

Item	Weight (lb)	Location		Moment	
		Long. Arm (in.)	Lat. Arm (in.) + = Right Side	Long. (in.-lb)	Lat. (in.-lb)
Basic empty weight	1460	106.2	0.2	155,052	292
Remove forward right door	-7.5	49.4	24.0	-371	-180
Remove forward left door		49.4	-24.0		
Remove aft right door		75.4	23.0		
Remove aft left door		75.4	-23.0		
Remove left seat controls		31.0	-13.0		
Pilot (forward right seat)	170	49.5	12.2	8415	2074
Left forward passenger	170	49.5	-10.4	8415	-1768
Aft right passenger	160	79.5	12.2	12,720	1952
Aft left passenger	130	79.5	-12.2	10,335	-1586
Baggage under forward right seat	10	44.0	11.5	440	115
Baggage under forward left seat	10	44.0	-11.5	440	-115
Baggage under aft right seat		79.5	12.2		
Baggage under aft left seat	10	79.5	-12.2	795	-122
Items on accessory mount bars	5	25.0	14.0	125	70
<b>Zero usable fuel weight and CG*</b>	<b>2117.5</b>	<b>92.7</b>	<b>0.3</b>	<b>196,366</b>	<b>732</b>
Usable main fuel at 6 lb/gal.	177	106.0	-13.5	18,762	-2390
Usable aux fuel at 6 lb/gal.	102	102.0	13.0	10,404	1326
<b>Takeoff Gross Weight and CG*</b>	<b>2396.5</b>	<b>94.1</b>	<b>-0.1</b>	<b>225,532</b>	<b>-332</b>

\* CG location (arm) for loaded helicopter is determined by dividing total moment by total weight.

**LOADING INSTRUCTIONS (cont'd)**

**LOADING CALCULATION WORKSHEET**

Item	Weight (lb)	Location		Moment	
		Long. Arm (in.)	Lat. Arm (in.) + = Right Side	Long. (in.-lb)	Lat. (in.-lb)
Basic empty weight					
Remove forward right door		49.4	24.0		
Remove forward left door		49.4	- 24.0		
Remove aft right door		75.4	23.0		
Remove aft left door		75.4	- 23.0		
Remove left seat controls		31.0	- 13.0		
Pilot (forward right seat)		49.5	12.2		
Left forward passenger		49.5	- 10.4		
Aft right passenger		79.5	12.2		
Aft left passenger		79.5	- 12.2		
Baggage under forward right seat		44.0	11.5		
Baggage under forward left seat		44.0	- 11.5		
Baggage under aft right seat		79.5	12.2		
Baggage under aft left seat		79.5	- 12.2		
Items on accessory mount bars		25.0			
<b>Zero usable fuel weight and CG*</b>					
Usable main fuel at 6 lb/gal.		106.0**	- 13.5		
Usable aux fuel at 6 lb/gal.		102.0**	13.0		
<b>Takeoff Gross Weight and CG*</b>					

\* CG location (arm) for loaded helicopter is determined by dividing total moment by total weight.

\*\* A longitudinal arm of 104.5 in. may be used for combined main and aux fuel. Do not use combined main and aux fuel if calculating lateral arm.

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### **EXTERNAL POWER RECEPTACLE (OPTIONAL)**

An optional 28-volt SAE AS35061-style external power receptacle is located inside the right engine cowl door. When the battery is switched on, the external power relay and the battery relay both close, connecting external power to the aircraft electrical system and battery. The external power relay will not close if reverse polarity is sensed by the receptacle.

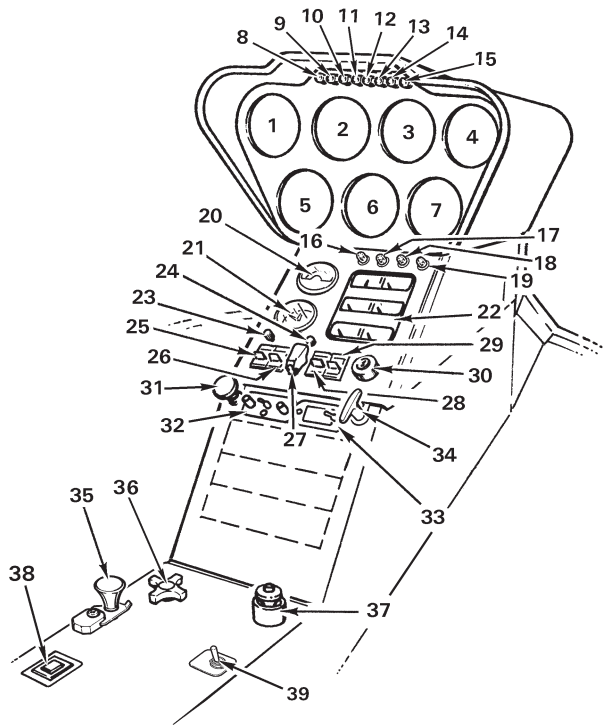
A separate wire from the external power receptacle to the battery bypasses the external power and battery relays. This wire allows battery charging via the external receptacle with the battery switch off. A 20-amp (10 amp on earlier aircraft) circuit breaker at the receptacle opens if current exceeds normal charging levels, and a diode provides polarity protection.

To use ground power for engine starting, have ground personnel connect ground power to the external receptacle prior to engaging starter, disconnect after engine start, and latch cowl door. Starts using ground power assist follow the same procedure as normal starts.

### **INSTRUMENT PANEL**

Standard primary instruments include an airspeed indicator, engine and rotor dual tachometer, altimeter, manifold pressure gage, and magnetic compass. Engine gages include an ammeter, oil pressure, oil temperature, cylinder head temperature, and fuel quantity for main and aux tanks. Also standard are a clock, a carburetor air temperature gage, and a digital outside air temperature gage. A collective-activated hourmeter is located right of the pilot's seat and may be used for recording time in service. (Older aircraft may have an hourmeter activated by engine oil pressure.)

Views of typical instrument panels are given on the following pages. Additional views of panels with electronic flight displays are found in the Optional Avionics Supplement in Section 9. Pilots should familiarize themselves with panel layout and equipment installations for each specific aircraft that they fly.



- |                             |                                 |
|-----------------------------|---------------------------------|
| 1. VERTICAL SPEED INDICATOR | 21. CLOCK                       |
| 2. OPTIONAL INSTRUMENT      | 22. ENGINE INSTRUMENTS          |
| 3. AIRSPEED INDICATOR       | 23. PANEL LIGHTS DIMMER         |
| 4. ENGINE AND ROTOR TACHS   | 24. ROTOR BRAKE LIGHT           |
| 5. ALTIMETER                | 25. NAVIGATION LIGHTS SWITCH    |
| 6. OPTIONAL INSTRUMENT      | 26. STROBE LIGHT SWITCH         |
| 7. MANIFOLD PRESSURE GAGE   | 27. CLUTCH ACTUATOR SWITCH      |
| 8. CLUTCH ACTUATOR LIGHT    | 28. ALTERNATOR SWITCH           |
| 9. M.R. GEARBOX TEMP LIGHT  | 29. BATTERY SWITCH              |
| 10. M.R. GEARBOX CHIP LIGHT | 30. IGNITION SWITCH             |
| 11. CARBON MONOXIDE LIGHT   | 31. CABIN HEAT                  |
| 12. STARTER-ON LIGHT        | 32. INTERCOM                    |
| 13. T.R. GEARBOX CHIP LIGHT | 33. OUTSIDE AIR TEMP/VOLTMETER  |
| 14. LOW FUEL LIGHT          | 34. CABIN AIR                   |
| 15. LOW RPM LIGHT           | 35. CARBURETOR HEAT             |
| 16. ALT LOW VOLTAGE LIGHT   | 36. CYCLIC FRICTION             |
| 17. ENGINE FIRE LIGHT       | 37. MIXTURE CONTROL             |
| 18. OIL PRESSURE LIGHT      | 38. ELT SWITCH (OPTIONAL)       |
| 19. GOVERNOR-OFF LIGHT      | 39. HEATED PITOT SWITCH (OPT'L) |
| 20. CARBURETOR AIR TEMP     |                                 |

**INSTRUMENT PANEL – TYPICAL (EARLIER AIRCRAFT)**

(Exact panel configuration may vary with optional equipment and date of helicopter manufacture.)

## **ENGINE MONITORING UNIT**

Later aircraft are equipped with an Engine Monitoring Unit (EMU), which is a digital recording device within the engine RPM governor control box. The EMU continuously monitors engine and rotor speed, engine oil temperature, cylinder head temperature, manifold pressure, ambient pressure, and outside air temperature.

EMU status is indicated by the EMU segment on the annunciator panel. The EMU segment will only illuminate while the annunciator panel test button is depressed. The EMU requires approximately ten seconds to complete a self-test after the aircraft battery is switched on. Once the self test is complete, steady illumination of the annunciator means normal EMU operation. A slowly flashing indication (once every two seconds) or no illumination means there is a fault in the EMU's senders or circuitry. A fast flashing indication (four times per second) is given if the EMU has detected an exceedance. EMU data can be downloaded to a computer with the appropriate software. A fault or exceedance should be investigated and the indication reset by a qualified mechanic prior to the next flight. Current exceedances may be reviewed (but not reset) on an Apple mobile device using an application available through the Robinson website.

The EMU is intended to be used only as a maintenance aid. It remains the pilot's responsibility to report any observed exceedances.

## **CABIN HEATING AND VENTILATION**

Fresh air vents are located in each door and in the nose. Door vents are opened and closed using the knob near the vent door hinge. A rotating knob is provided to lock vents closed. For maximum ventilation, open door vents wide during hover but only one inch or less during cruise. The rotating knob can be used to hold vents partially open.

The fresh air inlet in the nose is opened by pulling the vent handle on the console face. Rotating the vent handle clockwise will lock its position. Air from the nose inlet is directed along the inside surface of the windshield for defogging as well as for ventilation.

The cabin heater consists of a muffler heat shroud, a control valve at the firewall, outlets forward of the tail rotor pedals and in the rear footwells, and interconnecting ducting. A heater control knob located on the console face actuates the valve which directs heat either into the cabin or out an overboard discharge on the cabin underside.

### ***CAUTION***

In case of an in-flight engine fire, cabin heat should be turned off to seal cabin area from engine compartment.

## **SEATS, BELTS, AND BAGGAGE**

The seats are not adjustable but, on later aircraft, the pilot-side pedals are adjustable. Each helicopter is supplied with a removable back cushion to position the pilot farther forward. This allows shorter pilots to reach the pedals, the cyclic grip in its most forward position, and controls on the center console.

Heated seat bottoms and backrests for the forward seats are an option. Switches to control low and high heat settings are located at the bottom of the avionics console. The seat heaters operate only when the alternator switch is in the ON position to reduce the likelihood of inadvertently draining the battery before the engine is started.

### **COCKPIT CAMERA (OPTIONAL)**

An optional video camera may be installed in the cabin ceiling. The camera records 4K video, intercom/comm audio, and GPS position both internally and to a removable flash drive inserted in the front of the camera housing. The internal memory retains only recent video and is not user accessible. Recording starts automatically when the helicopter battery is switched on and stops when it is switched off.

Recording to the flash drive can be stopped or audio muted using the record and audio switches on the front of the camera housing. Do not remove the flash drive while a recording is in progress as this will corrupt the video file. To remove a flash drive when the helicopter battery switch is on, first stop the recording using the record switch.

A blue flashing light on the camera housing indicates video is being recorded to the flash drive. A green steady light indicates the camera is powered and operating normally. The green light will change to an amber flashing light if an internal camera fault is detected, in which case video may not be recorded.

Video recorded on the flash drive can be viewed on a Windows PC or Mac computer. Video is recorded in sequential 4 GB files with each file approximately 25 minutes in length. Video files are labeled HELICAM\_XXXX.MP4, where XXXX is a sequential number. GPS position and altitude are optionally displayed in the video and are also recorded separately to files labeled HELICAM\_XXXX.GPX. A 128 GB flash drive (as supplied with helicopter) will record approximately 10 hours of video. When full, the earliest video file is overwritten with the last recording.

#### ***NOTE***

Flash drives must meet the criteria described in the *Cockpit Camera User Guide* in order to function reliably.

### **COCKPIT CAMERA (OPTIONAL) (cont'd)**

The *Cockpit Camera User Guide* is available on the Robinson website, [www.robinsonheli.com](http://www.robinsonheli.com), and includes additional information on camera operation, playback options, and troubleshooting.

### **CYCLIC GUARD (OPTIONAL)**

The optional cyclic guard is a bar that extends from the inboard corner of the left front seat to the instrument console. It is intended to act as a barrier to help prevent inadvertent interference with the cyclic control. The guard also provides a hand grip for a passenger's right hand.

In order to access the under seat compartment with the guard installed, pull the silver spring knob at the forward end of the guard and allow the aft end to rotate down away from the seat hinge. To re-secure the guard, lift the aft end and allow the spring knob to lock back in place.

It is recommended that the guard be installed whenever a non-pilot passenger occupies the left front seat. A pilot flying from the left seat may find that the guard contacts the right leg when feet are on the pedals. The guard should be removed prior to flight if the pilot finds it objectionable.

FAA APPROVED  
R44, R44 II, R44 CADET  
PILOT'S OPERATING HANDBOOK

HELISAS AUTOPILOT SUPPLEMENT

This supplement must be included in the FAA-approved Pilot's Operating Handbook when the HeliSAS autopilot is installed.

The information contained herein supplements or supersedes the basic manual only in those areas listed in this supplement. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

APPROVED BY:   
*for* Manager, Flight Test Branch, ANM-160L  
Federal Aviation Administration, LAACO  
Transport Airplane Directorate

DATE: September 8, 2014

LOG OF REVISIONS

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\* Manufacturer's data, not FAA approved.

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Date: 2022.03.15 07:03:08 -07'00'  
Manager, West Flight Test Section, AIR-716  
Federal Aviation Administration  
Los Angeles *Acting,*

DATE: 15 MAR 2022

## **SECTION 1: GENERAL**

### **INTRODUCTION**

This supplement contains the changes and additional data applicable when the HeliSAS autopilot is installed.

There are two versions of the HeliSAS autopilot. The earlier version (designated Version 51) has a BC (backcourse) button on the control panel. The later version (designated Version 52) replaces the BC button with a SPD (speed) button on the control panel.

The autopilot's primary Stability Augmentation System (SAS) mode maintains a steady helicopter attitude by applying corrective inputs to the cyclic. Additional modes providing heading hold, altitude hold, airspeed control (Version 52), and navigation functionality are also selectable. The autopilot does not provide any collective or pedal inputs. The system is designed as a "fly through" system meaning the pilot can override as desired for maneuvering without disengaging the system. Only a few pounds of force at the cyclic are required for override, and the system will not disconnect due to pilot cyclic inputs.

### ***CAUTION***

The autopilot is intended to enhance safety by reducing pilot workload. It is not a substitute for adequate pilot skill nor does it relieve the pilot of the responsibility to monitor the flight controls and maintain adequate outside visual reference.



## SECTION 2: LIMITATIONS

### FLIGHT AND MANEUVER LIMITATIONS

Pilot's hand must be on cyclic grip under the following conditions:

During autopilot engagement or intentional disengagement

At altitudes less than 200 feet AGL

Minimum altitude for use of autopilot ALT mode is 200 feet AGL.

For practice instrument approaches, minimum altitude for use of autopilot VRT mode is 50 feet AGL

## SECTION 3: EMERGENCY PROCEDURES

### AUTOPILOT DISENGAGEMENT OR FAILURE

The autopilot is designed to automatically disengage if the system detects a fault. Disengagement is normally indicated by four beeps in the headset. If the autopilot does not automatically disengage, failure may be recognized by erratic cyclic control motion, abnormal cyclic stick forces, or deviations in pitch or roll.

1. Continue flight using manual control. If autopilot has not disengaged, manually disengage using cyclic AP OFF button or control panel SAS button.
2. If SAS annunciator on control panel is steady white, re-engagement may be attempted at pilot's discretion.

#### ***CAUTION***

Although unlikely, it is possible for certain faults to cause disengagement without the four-beep aural warning.

### SECTION 3: EMERGENCY PROCEDURES (cont'd)

#### AUTOPILOT DISENGAGEMENT OR FAILURE (cont'd)

##### ***CAUTION***

Due to the unstable nature of helicopters, autopilot disengagement requires immediate pilot attention. Always monitor helicopter attitude and flight controls, and be prepared to take manual control.

##### ***NOTE***

The system automatically switches off all modes except SAS mode at airspeeds below 44 KIAS or above 130 KIAS, accompanied by a single beep. This is by design and not a system failure. The high speed limit is not intended to provide  $V_{ne}$  protection. It is the pilot's responsibility to observe  $V_{ne}$  limits.

### SECTION 4: NORMAL PROCEDURES

#### **GENERAL**

Autopilot controls and operating modes are described in Section 7, Systems Description.

##### ***NOTE***

Cyclic friction must be fully off for autopilot to work properly. Cyclic friction will degrade autopilot performance.

**SECTION 4: NORMAL PROCEDURES (cont'd)**

**STARTING ENGINE AND RUN-UP**

After "Hydraulic system", add:

- Autopilot . . . . . Check
- Airspeed and altitude bugs . . . . . Set (Version 52)

***NOTE***

For autopilot check, wear headset and ensure cyclic friction is off. Engage SAS mode. Verify cyclic exhibits centering tendency and SAS annunciator on control panel turns green. Disengage. Verify 4 beeps in headset, cyclic reverts to normal hydraulic system feel, and SAS annunciator turns white.

**TAKEOFF PROCEDURE**

Autopilot SAS mode may be engaged as desired on the ground or at any time during the takeoff procedure. Re-trim as necessary to eliminate undesirable cyclic forces.

**CRUISE**

Add:

Engage autopilot modes as desired. In SAS mode, re-trim as necessary to eliminate undesirable cyclic forces.

***CAUTION***

It is the pilot's responsibility to monitor flight controls, aircraft flightpath, traffic, and terrain even while the autopilot is engaged. The autopilot is designed to disengage in the event of a fault. Be prepared to take control if required.

**SECTION 5: PERFORMANCE**

No change.

**SECTION 6: WEIGHT AND BALANCE**

No change.

**SECTION 7: SYSTEMS DESCRIPTION**

**AUTOPILOT**

The HeliSAS autopilot system consists of two electric servomotors, a flight control computer, an autopilot control panel, and control buttons on the cyclic grip. One servomotor controls pitch and is installed in the control tunnel forward of the cyclic stick. The other servomotor controls roll and is installed under the pilot's seat. The servomotors are connected to the cyclic through electromagnetic clutches.

The flight control computer is installed on the forward panel under the pilot's seat, and the autopilot control panel is installed in the avionics stack.

The autopilot senses aircraft attitude using a combination of sensors in the flight control computer and an independent onboard attitude source such as the Attitude Heading Reference System (AHRS) for the Primary Flight Display (PFD). The computer then sends signals to the servomotors which are connected to the bottom of the cyclic in the control tunnel.

The primary autopilot mode is Stability Augmentation System (SAS) mode which maintains a steady helicopter attitude by applying corrective inputs to the cyclic. This is felt as a light cyclic centering force. Additional modes may be layered on top of SAS mode and are described below. The pilot can override as desired for maneuvering without disengaging the system. Only a few pounds of force at the cyclic are required for override, and the system will not disconnect due to pilot cyclic inputs.

The control panel has a row of buttons to control autopilot modes and annunciators to indicate mode status. A dark annunciator indicates that a mode is off, a white annunciator indicates that a mode is armed or on standby, and a green annunciator indicates that a mode is active.

## SECTION 7: SYSTEMS DESCRIPTION (cont'd)

### AUTOPILOT (cont'd)

When the avionics master is switched on, the autopilot performs a self-test and then enters SAS standby mode. All of the control panel indicators flash alternating white and green during the self-test. Four headset beeps occur at the beginning of the self-test as a check of the aural warning function. The SAS annunciator on the control panel turns steady white when the self-test is complete.

#### **NOTE**

Autopilot will not enter standby mode if attitude indicator is not functioning or indicated bank angle is greater than 6 degrees.

The autopilot SAS mode is engaged either by pressing the SAS button on the control panel or by pressing the TRIM button on the cyclic for more than 1.25 seconds. Additional modes are engaged by pressing the appropriate button on the control panel. The additional modes are disabled and will not engage at airspeeds below 44 KIAS or above 130 KIAS.

To disengage any mode, push the appropriate button on the control panel

#### **NOTE**

Disengaging SAS mode will also disengage all other modes.

Modes may also be disengaged using the AP OFF button on the cyclic. If only SAS mode is engaged, push the AP OFF button once to disengage. If additional modes are engaged, push the AP OFF button once to disengage all modes except SAS and a second time to disengage SAS mode, or push and hold the AP OFF button to disengage all modes including SAS

## SECTION 7: SYSTEMS DESCRIPTION (cont'd)

### AUTOPILOT (cont'd)

#### **NOTE**

SAS disengagement should always be accompanied by four beeps in the headset. If beeps do not occur, maintenance is required.

Safety monitors automatically disengage individual modes or the entire system if a fault is detected. Automatic disengagement of SAS mode (or the entire system) is indicated by four beeps in the headset. Automatic disengagement of any mode other than SAS is indicated by a single beep in the headset. There is no audio indication for intentional disengagement of modes other than SAS.

#### **NOTE**

The system also automatically reverts to SAS mode at airspeeds below 44 KIAS or above 130 KIAS, accompanied by a single beep. The high speed limit is not intended to provide  $V_{ne}$  protection. It is the pilot's responsibility to observe  $V_{ne}$  limits.

The TRIM button is used to re-set the target attitude (to re-trim) while in SAS mode. Use a small amount of force to override the autopilot and then push and release the TRIM button at the new desired condition. If the force to override is objectionable, the TRIM button may be held down during maneuvers. The system will re-trim to the attitude at which the TRIM button is released. For Version 52, stick forces felt during override will gradually wash out to near zero without use of TRIM button if override is maintained.

#### **NOTE**

The system will not re-trim to angles more than approximately  $10^\circ$  in pitch or roll.

## SECTION 7: SYSTEMS DESCRIPTION (cont'd)

### AUTOPILOT (cont'd)

#### **NOTE**

When engaging SAS mode from standby, for angles of less than approximately 10° in pitch and roll, SAS holds the current angles. If either pitch or roll is larger than approximately 10°, the system assumes an unusual attitude and gently levels the helicopter.

The autopilot is protected by a dedicated circuit breaker on the avionics bus (autopilot is not powered with the avionics master switch off).

Heading Mode (HDG) – maintains the heading selected by the heading bug on the directional gyro or Horizontal Situation Indicator (HSI) display. Aircraft can be steered using the heading bug.

Altitude Mode (ALT) – maintains altitude at the time of engagement or of last TRIM button release. The target altitude is reset each time the TRIM button is pressed and released.

#### **NOTE**

The autopilot uses pitch attitude to maintain altitude or follow an approach glidepath. It does not have any control of power setting. The pilot must manage power with the collective to control speed and rate of climb or descent. Make small, smooth power changes to allow the system to adjust to new power settings.

## SECTION 7: SYSTEMS DESCRIPTION (cont'd)

### AUTOPILOT (cont'd)

Navigation Mode (NAV) – tracks the active GPS or VLOC course displayed on the Course Deviation Indicator (CDI). If no CDI is installed, NAV will only track the active GPS course displayed on the GPS.

NAV may be armed prior to intercepting the active course. NAV annunciator is white when NAV is armed and turns green at course intercept. If HDG is active when NAV is armed, the autopilot will fly the selected heading until course intercept. If HDG is not active, the autopilot will select a 45° intercept angle.

Vertical Navigation Mode (VRT) – tracks an ILS glideslope or GPS approach vertical guidance. Arm VRT (annunciator turns white when armed) prior to intercepting the glidepath. VRT annunciator will turn green at glidepath intercept.

#### **NOTE**

Pushing the ALT button while VRT is armed or active will turn off VRT. VRT must be re-armed or re-engaged as desired.

#### **NOTE**

Reducing power to approach setting just prior to glidepath intercept is recommended.

### Speed Mode (SPD) (Version 52 only)

Speed mode uses cyclic pitch to control airspeed. Exact behavior varies with configuration of airspeed and altitude bugs on the PFD as described below.

The altitude bug is displayed above the altitude tape and the airspeed bug is displayed above the airspeed tape. The appearance of all dashes or a blank field indicates a bug is not set.



## SECTION 7: SYSTEMS DESCRIPTION (cont'd)

### AUTOPILOT (cont'd)

#### Speed Mode (SPD) (Version 52 only) (cont'd)

If an airspeed bug is not set, selecting SPD holds the current airspeed. The target speed is reset each time the trim button is pressed and released.

If an airspeed bug is set, selecting SPD holds airspeed at the bug setting. Changing the bug will change the target airspeed.

If an altitude bug is set, selecting SPD will also arm ALT (ALT LED white) for altitude capture. The mode will switch from SPD to ALT if the selected altitude is crossed. There will be a brief period in capture mode with the ALT LED flashing white/green.

#### **NOTE**

Do not change the selected altitude during ALT capture (ALT LED flashing white/green). System may pitch up or down to chase bug and may not capture altitude.

#### **NOTE**

Different brands of PFD behave differently in terms of bug settings at power up and how bugs are manually set. Refer to PFD manufacturer's documents for proper use. Verify desired bug settings before engaging SPD mode.

## **SECTION 7: SYSTEMS DESCRIPTION (cont'd)**

### **AUTOPILOT (cont'd)**

Backcourse Mode (BC) (Version 51 only) – reverse CDI sensing for backcourse approaches. Course on HSI should be set so that tail of course pointer points toward runway (set to inbound front course).

Airspeed Protection (Version 52 only) – Minimizes the possibility of the ALT mode to fly the helicopter to an airspeed below 44 KIAS due to insufficient power, or the VRT mode to fly the helicopter to an airspeed above 130 KIAS due to excess power when flying a precision approach glideslope. When triggered, it causes the longitudinal mode to change from ALT (at low airspeed) or VRT (at high airspeed) to SAS mode with a commanded pitch attitude of 2 degrees nose down. Since the mode change is not commanded by the pilot, a single warning beep is annunciated.

### **REMOVABLE FLIGHT CONTROLS**

On later aircraft, disconnect the electrical connector for the left-hand trim button located near the quick release pin before removing the left cyclic grip. Reconnect the connector when installing the left cyclic grip.

## **SECTION 8: HANDLING AND MAINTENANCE**

No change.

## **SECTION 10: SAFETY TIPS**

The autopilot is intended to reduce pilot workload and enhance safety. It is important that pilots do not misuse this capability and allow their attention to be diverted. Pilots should continue monitoring the flight controls and helicopter attitude as well as looking for traffic and other obstacles. Autopilot disengagement requires immediate pilot attention. Pilots must always be prepared to take manual control.

The autopilot is not certified for flight in Instrument Meteorological Conditions (IMC). Adhering to appropriate VFR weather minimums is essential for safety.

If an inadvertent loss of outside visual reference occurs, the pilot must regain visual conditions as quickly as possible while avoiding abrupt, disorienting maneuvers. The following procedure is recommended:

1. If not already engaged, immediately engage autopilot SAS mode and allow autopilot to recover from unusual attitude if one has occurred.
2. Select a heading and altitude to ensure terrain and obstacle clearance. Turns and/or climbs may be required. Engage additional autopilot modes as desired for workload reduction.
3. While maintaining terrain and obstacle clearance, maneuver toward conditions of improved visibility.

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**PILOT KNOWLEDGE AND PROFICIENCY (cont'd)**

- Flight planning (*Ref SNs 15, 26, and 43*)
  - Thorough preflight inspection
  - Fuel
  - Weather
  - Performance (hot/high/loading)
- Distractions (*Ref SNs 16, 34, 36, and 41*)
  - Failure to keep eyes outside scanning for wires, other obstacles, and traffic
  - High workload missions such as photo flights
  - Passengers
  - Avionics
  - Cell phones
- Low-G and mast bumping (*Ref SNs 11, 29, and 32*)
  - Avoidance
    - Reduce airspeed in turbulence
    - Monitor airspeed when lightly loaded
    - Ensure passenger controls are removed
  - Recognition and recovery

**CAUTION**

Never practice/demonstrate low-G in flight.  
Low-G training should be knowledge based only.

- Low RPM considerations (*Ref SNs 10, 24, and 29*)
  - Recognition and recovery
- Power failures (*Ref SNs 10, 24, and 29*)
  - Instinctive autorotation entry
  - Continuously consider emergency landing sites throughout every flight
- Practice autorotations (*Ref SN 38*)
  - Proven, safe methods

**CAUTION**

In-flight practice of Low RPM, power failures, and autorotations should only be conducted under the supervision of an instructor.

- Carburetor ice (*Ref SNs 25 and 31*)
  - Conditions conducive
  - Use of carb heat
- Confined area operations (*Ref SN 22*)
  - High and low reconnaissance
  - Assessing wind
  - Power margins

## **SAFETY NOTICES**

The following Safety Notices have been issued by Robinson Helicopter Company as a result of various accidents and incidents. Studying the mistakes made by other pilots will help you avoid making the same errors. Safety Notices are available on the RHC website: [www.robinsonheli.com](http://www.robinsonheli.com).

### **SAFETY NOTICE**

### **TITLE**

SN-1	Inadvertent Actuation of Mixture Control in Flight
SN-9	Many Accidents Involve Dynamic Rollover
SN-10	Fatal Accidents Caused by Low RPM Rotor Stall
SN-11	Low-G Pushovers - Extremely Dangerous
SN-13	Do Not Attach Items to the Skids
SN-15	Fuel Exhaustion Can Be Fatal
SN-16	Power Lines Are Deadly
SN-17	Never Exit Helicopter with Engine Running Hold Controls When Boarding Passengers Never Land in Tall Dry Grass
SN-18	Loss of Visibility Can Be Fatal Overconfidence Prevails in Accidents
SN-19	Flying Low Over Water is Very Hazardous
SN-20	Beware of Demonstration or Initial Training Flights
SN-22	Vortex Ring State Avoidance, Recognition, and Recovery
SN-23	Walking into Tail Rotor Can Be Fatal
SN-24	Low RPM Rotor Stall Can Be Fatal
SN-25	Carburetor Ice
SN-26	Night Flight Plus Bad Weather Can Be Deadly
SN-27	Surprise Throttle Chops Can Be Deadly
SN-28	Listen for Impending Bearing Failure Clutch Light Warning
SN-29	Airplane Pilots High Risk When Flying Helicopters
SN-30	Loose Objects Can Be Fatal
SN-31	Governor Can Mask Carb Ice
SN-32	High Winds or Turbulence
SN-33	Drive Belt Slack
SN-34	Aerial Survey and Photo Flights - Very High Risk
SN-35	Flying Near Broadcast Towers
SN-36	Overspeeds During Liftoff
SN-37	Exceeding Approved Limitations Can Be Fatal
SN-38	Practice Autorotations Cause Many Training Accidents
SN-39	Unusual Vibration Can Indicate a Main Rotor Blade Crack
SN-40	Post-Crash Fires
SN-41	Pilot Distractions
SN-42	Unanticipated Yaw
SN-43	Use Extra Caution During Post-Maintenance Flights
SN-44	Carrying Passengers

## **Safety Notice SN-22**

Issued: July 1986 Revised: June 1994; October 2016, January 2024

### VORTEX RING STATE AVOIDANCE, RECOGNITION, AND RECOVERY

A vertical descent or steep approach, particularly downwind, can cause the rotor to fly into its own downwash. At certain descent rates, large vortices develop as the downwash is recirculated through the rotor disk. This condition is known as vortex ring state (VRS). Once VRS exists, adding power (raising collective) can unexpectedly increase descent rate due to the increase in downwash recirculating through the rotor. Recovery can only be accomplished by moving the rotor disk out of its own downwash.

To avoid VRS, reduce rate of descent before reducing airspeed. A good rule to follow is never allow your airspeed to be less than 30 knots until your rate of descent is less than 300 feet per minute.

Signs that VRS is developing include increased vibration levels, decreased control authority ("mushy controls"), and a rapid increase in sink rate. Pilots should always be aware of wind conditions and plan descents to avoid VRS. Pilots should be particularly alert to the possibility of VRS during OGE hover operations or steep approaches.

A recovery should be initiated as soon as VRS is suspected. Early recognition and immediate recovery by moving the rotor out of its downwash is essential. Large control inputs are not necessary and should be avoided. After recovery, increasing collective and/or airspeed will help to avoid re-entering VRS.

## **Safety Notice SN-23**

Issued: Jul 86    Rev: Jun 94

### WALKING INTO TAIL ROTOR CAN BE FATAL

Non-pilot passengers have been killed by inadvertently walking into a rotating tail rotor. Every possible precaution must be taken by the pilot to prevent this tragic type of accident. The following rules should always be observed:

- 1) Never allow anyone to approach the helicopter unless they are escorted or have been properly instructed. If necessary, shut down and stop rotors before boarding passengers.
- 2) Always have strobe light flashing when rotors are turning.
- 3) Instruct passengers to establish and maintain eye contact with pilot when approaching helicopter. (This will force them to approach only from the nose or side, never the tail).
- 4) Instruct passengers to leave the helicopter in full view of the pilot and walk only around the nose, never the tail.
- 5) Be especially careful when landing off airports as unseen children or adults might approach the helicopter from the rear.