Cobham Commercial Systems

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The most important thing we build is trust

AVIONICS AND SURVEILLANCE DIVISION

End to end avionics and covert surveillance solutions

DEFENCE SYSTEMS DIVISION

Critical technology for network centric operations

MISSION SYSTEMS DIVISION

Complete 'nose to tail' refuelling and 'wingtip to wingtip' mission systems capability

AVIATION SERVICES DIVISION

Operates, modifies and maintains more than 150 fixed and rotary wing aircraft around the world

HeliSAS® Autopilot and Stability Augmentation System

HeliSAS Autopilot and Stability Augmentation System

Lightweight, affordable stability in an unstable world

Reduced Pilot Workload

- With autopilot engaged, other cockpit duties can be performed hands-free

Increased Stability

- Automatically recover to a neutral attitude simply by releasing the cyclic

HeliSAS®

COBHAM

HeliSAS Autopilot and Stability Augmentation System

Lightweight, affordable stability in an unstable world

Confident Command

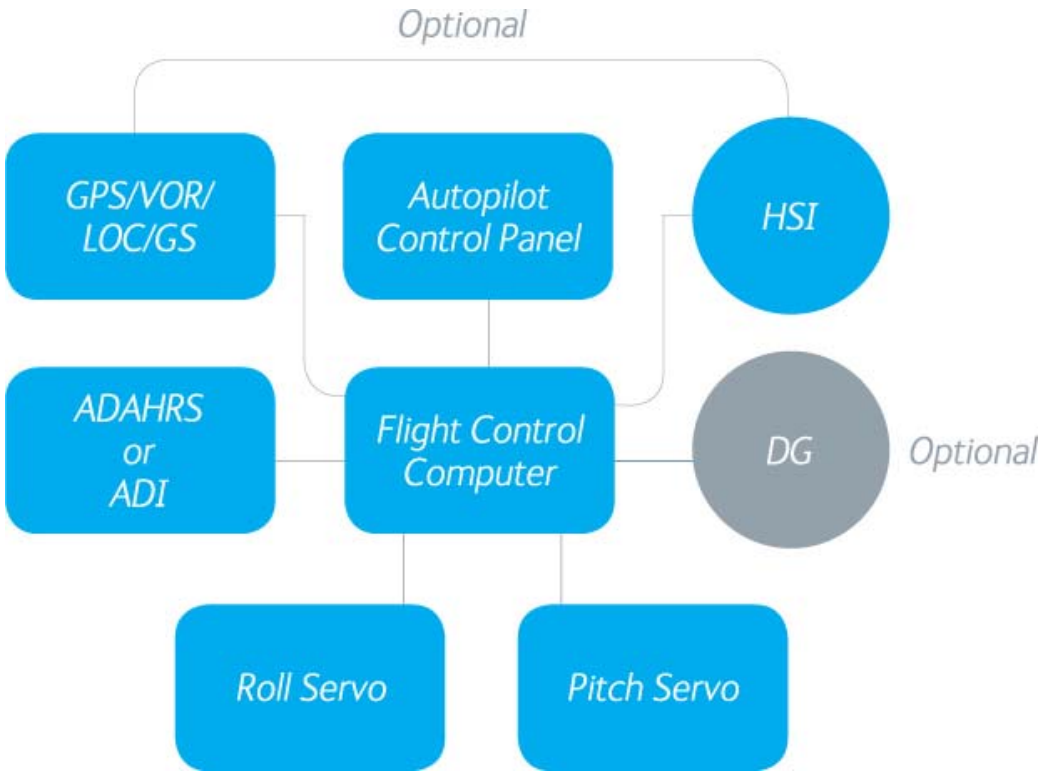
- Autopilot can be commanded to maintain heading and altitude or navigation course and altitude

Light-to-Medium Helicopters

- Designed and priced specifically for light-to-medium helicopters

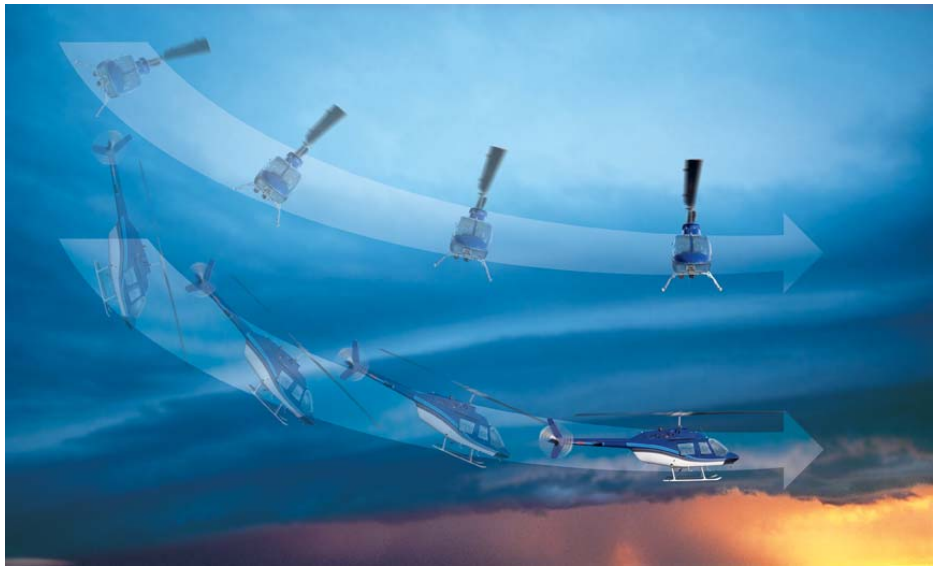
HeliSAS®

Cobham HeliSAS is a stability augmentation system (SAS) and two-axis autopilot that provides attitude stabilization and force feedback to the cyclic control. Autopilot functions include Heading select, Navigation, and automatic instrument approach modes.



HeliSAS® Background

- HeliSAS initially designed by Hoh Aeronautics, Inc. (HAI) with funding provided by SBIR grant from NASA Ames Research Center; further development and initial STC completed by Cobham Avionics; Cobham Avionics has exclusive IP sub-license agreement with HAI.
- FAA approved STC for R44 (Raven I and II)
- FAA TSO approved
- Bell 206 & 407 STC's and AS 350 in process
- STC's for Eurocopter EC 120, & EC 130 planned for 2011
- UH-1 and OH-58 installations in work



Unique HeliSAS Features

- Much lighter than existing helicopter SAS and autopilots < 16 lbs vs. 50 lbs+ for other current systems
- Much lower cost than existing helicopter SAS and autopilots
- Easy installation – estimate 40 to 60 man hours
- Low cost and lightweight achieved with parallel servo architecture; does not require removal and replacement of flight control rods

System Overview

- Designed as an attitude-based system that accepts attitude source data using a combination of the installed attitude gyro or digital attitude heading reference system (AHRS) inputs, and motion sensors located in the Flight Control Computer (FCC).
- Full authority, parallel servo design.
- System provides commanded attitude retention in SAS mode.
- The "outer loop" or autopilot control functions include Heading select, Altitude hold, automatic Navigation, Localizer Back Course capture, and Vertical guidance capture for ILS and VNav approach functions.
- HeliSAS employs a dual fail passive architecture wherein identical safety monitors are implemented in both of the internal processors and either processor can disengage the system if a monitor is tripped.

HeliSAS® Block Diagram

HeliSAS as installed in a Bell 206B Jet Ranger

CYCLIC AP DISC
and TRIM BUTTONS

ROLL
SERVO

FCC

CASTLEBERRY ATTITUDE
INDICATOR # 504-0027-94201
or AHRS

PITCH
SERVO

HeliSAS CONTROL PANEL (HCP)

HeliSAS® Components and Description

- HeliSAS Control Panel (HCP) – HeliSAS Control Panel. The HCP interfaces with the FCC. This push button panel located in the cockpit within the pilot's reach provides for engagement of the SAS and the desired autopilot mode selections of altitude hold, heading hold, navigation signal tracking, and vertical (approach) navigation features, which are controlled via the six push buttons on the panel

- Immediately above each Control Panel button is a dual color sunlight readable LED used to indicate the armed (white) or active (green) state of each mode

- Weight = .53 lbs.

HeliSAS® Components and Description

- Flight Control Computer (FCC) – The Flight Control Computer receives inputs from the HCP as well as from the on-board NAV, GPS and Attitude systems and commands the pitch and roll servos to perform the selected autopilot function.

- Internal to the FCC are three body axis rate sensors, a triaxial accelerometer, two differential pressure sensors, and one absolute pressure sensor. The rate sensors and accelerometer are used to sense the rotational velocities and acceleration of the HeliSAS in three orthogonal axes. The pressure sensors are used to detect and calculate the indicated airspeed and altitude of the airframe.

- DO 178b Level A software

- Weight = 1.68 lbs.

HeliSAS® Components and Description

Cyclic Mounted Controls

- TRIM Switch - The Momentary Trim button provides a force-trim-release function to allow the pilot to retrim to a new pitch or roll attitude in SAS mode. Holding down the momentary trim button for at least 1.25 seconds engages SAS if not already "on". The Momentary Trim button can also be used to reset the reference altitude in the altitude-hold mode. It can also be used to reset the reference track angle in HDG mode if no heading source is available.

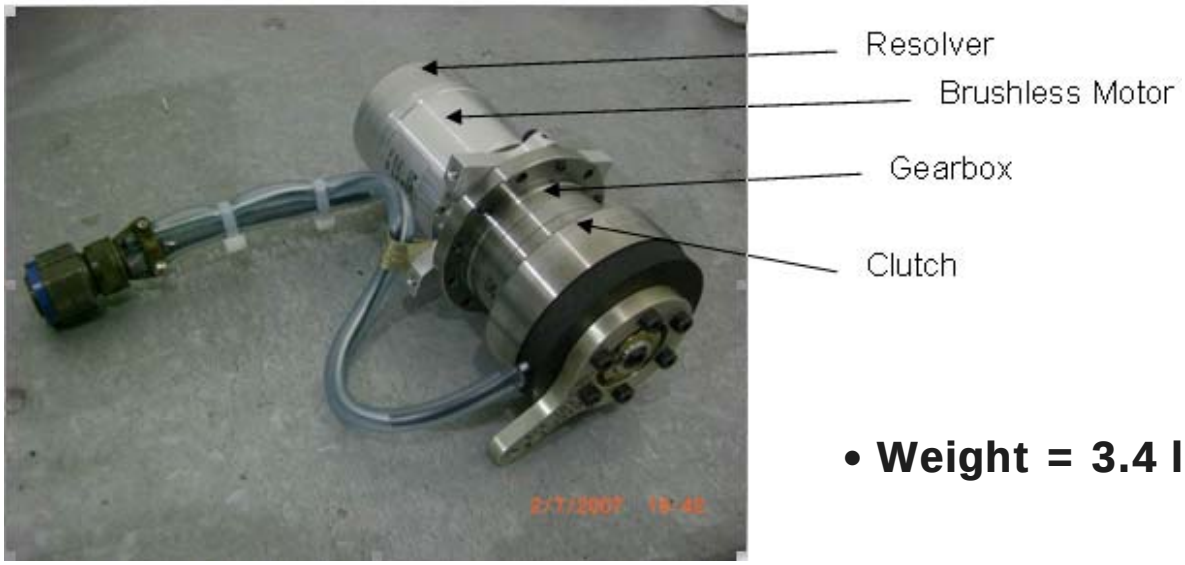
- AP DISC Switch
  - First press disconnects AP functions
  - Second press disconnects SAS functions
  - If pressed and held for more than 3 seconds, all disengage

FTR Switch and AP DISC Switch

HeliSAS® Components and Description

Pitch and Roll Servos

- Electromechanical servo-actuators consisting of a DC brushless commutating motor, low ratio gearbox, clutch, and servo position feedback resolvers that control the pitch and roll axes of the helicopter
- Connected to the flight control system in parallel with the basic helicopter control rods and have manual servo back-drive capability.
- Clutches consist of an electromagnetic pressure plate design that disconnects the servo-actuators from the flight control system when the HeliSAS is selected off. Loss of power to the clutches causes them to fail to the open, clutch face separated position.



- **Weight = 3.4 lbs.**

Modes of Operation

- **Standby Mode**
  - Ready for SAS Mode to be engaged; indicated by white LED above SAS on the control panel
- **Stability Augmentation System (SAS)**
  - Engaged via push-button on HCP or cyclic; operation indicated by green LED illuminated on the control panel
  - Used to maintain commanded pitch and roll attitude
  - Pilot can "fly through at any time; release pressure and aircraft returns to previously commanded attitude
  - Attitude reset by pilot via FTR button on cyclic

Modes of Operation

- **Autopilot Modes – engaged via push buttons on HCP when SAS "on" and indicated airspeed >44 KIAS; capture indicated by illumination of green LED above the function**
  - Heading (HDG); used to Turn to a Selected Heading and Hold it; pilot control via HSI or EFIS
  - Navigation (NAV) Mode; used to Intercept and Track a VOR, LOC FRONT Course, GPS Course
  - BC (Back Course) Mode; used to Intercept and Track a Reciprocal VOR, LOC BACK Course, GPS Course
  - Altitude (ALT) Mode; used to hold current Altitude
  - Vertical Navigation (VRT) Mode; used to Intercept and Track an ILS Glide slope, and GPS VNAV, LNAV +V, or LPV Glide path

System Normal Operation

- During the system power-up self-test, all of the LEDs on the HCP are flashing, alternately between white and green. Upon completion of the self-test, all HCP LEDs remain illuminated white, indicating system is in Stand-by mode.
- SAS mode can be engaged prior to liftoff via SAS push button on HCP or via cyclic FTR button >1.25 sec.; SAS LED changes to green and other LED's turn off.
- SAS provides attitude retention; in hover pilot can make "fly through" corrections and retrim attitude via FTR on cyclic; may be used in forward flight for pitch and roll retention up to +5 deg or -5 deg and pitch up to +11deg or -6 deg; pilot can "fly through" to greater pitch and roll angles and when input is relaxed helicopter returns to trim limits.
- The various autopilot modes can only be engaged when the SAS mode is already engaged and the airspeed is greater than 44 KIAS; pilot engages via push buttons on HCP; associated LED green light illuminates.
- Disengage AP modes individually via HCP push buttons or all modes via cyclic AP Disc button; single 600 Hz aural beep in headset.
- Disengage SAS via HCP push button or via cyclic AP Disc button; aural 600Hz tone in headset; 4 beeps.

System Safety Monitors

- Power-Up - During the system power-up self-test, an aural alert comprised of four 600 Hz beeps is heard in the headset.

- HeliSAS is a fail-passive system, meaning that it will automatically disengage the SAS mode prior to any significant cyclic motion, whenever system safety monitors sense a related failure. This will be accompanied by a four beep 600Hz aural alert heard in the headset.

- SAS Mode Engaged - If the safety monitors detect a system failure affecting the integrity of the engaged SAS mode, they will automatically disengage the SAS mode along with any other autopilot modes that may happen to be engaged, and return the system to Standby Mode. This is accompanied by the four-beep aural alert sequence heard in the headset.

- If the pilot intentionally disengages the SAS mode the system will be returned to Standby mode. This is accompanied by the four beep aural alert sequence heard in the headset.

Safety Monitors

- SAS Mode and Autopilot Mode(s) Engaged - If the safety monitors detect a system failure affecting the integrity of an engaged autopilot mode they will then automatically disengage that particular autopilot mode, leaving the SAS mode engaged. This will be accompanied by a single beep aural alert heard in the headset.

- If the safety monitors detect the loss of a navigation signal they will then automatically disengage the particular autopilot mode dependent upon that signal, but leave the SAS mode engaged. This will be accompanied by a single beep aural alert heard in the headset.

- If the pilot intentionally disengages a particular autopilot mode the SAS mode will remain engaged and there will be no accompanying aural alert heard in the headset.

- Pressing the cyclic-mounted TRIM Switch once disengages all autopilot modes. A second press disengages the SAS mode. Pressing and holding the cyclic mounted AP DISC Switch for more than 1.25 seconds disengages the SAS mode and all autopilot modes.

HeliSAS® Contact Information

HeliSAS Questions? Contact:

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Or visit our web site:
www.HeliSAS.com