MARCONI-ELLIOTT AVIONICS

Helicopter AFCS

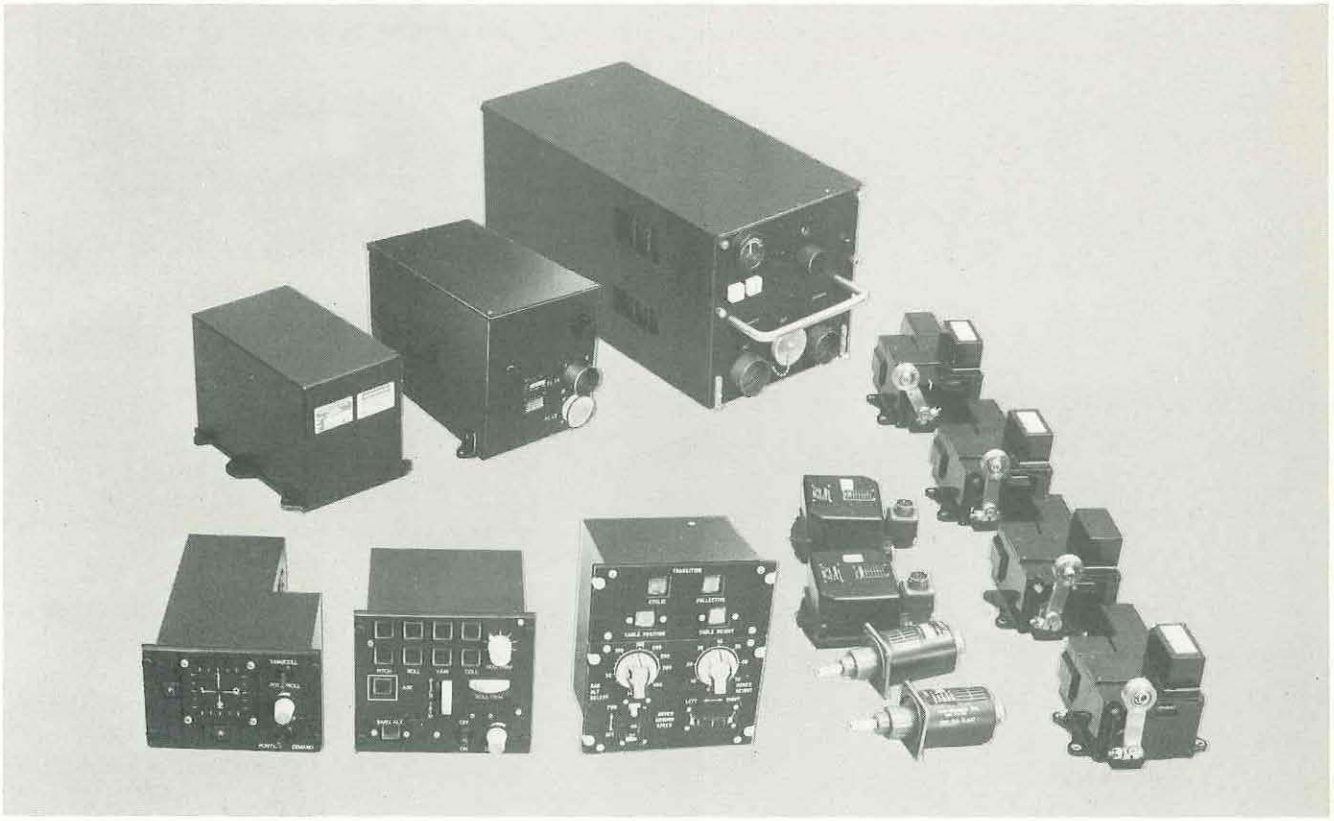
Introduction

A system has been developed to provide automatic stabilization of a helicopter in pitch, roll and yaw axes.

A number of autopilot facilities have also been developed; these can be used in various combinations to suit particular role requirements. The complete autopilot facilities currently available are:—

- Heading Hold
- Barometric Altitude Hold
- Radio Altitude Acquire and Hold
- Airspeed Hold
- Automatic Transition
- Sonar Cable Hold (Angle and Height)

This system with the exception of Airspeed Hold is fitted to the Lynx (WG13) Helicopter.



The Automatic Stabilizer

The system provides attitude stabilization in the pitch and roll axes. Stabilization demands are fed to limited authority series actuators which in turn drive the main powered flying controls. In the yaw axis the system operates as a yaw rate damping system to stabilize the aircraft during manual and automatic flight.

All autostabilization channels are fully duplicated with monitoring circuits to indicate discrepancy between lanes.

The autostabilizer is active throughout the flight envelope and is also operational during autopilot flying.

A unique feature of the autostabilizer is the introduction of a simple control system to provide additional pitch axis stability by sensing normal aircraft acceleration and applying a collective pitch demand to combat the pitch rate divergence and instability at high forward speed and aft CG. This control system has also resulted in a reduction of pitch stick activity and pilot work load over the flight envelope particularly in turbulence and manoeuvreing flight.

This system is called the Collective Acceleration Control (CAC).

The Autopilot

The autopilot modes of Barometric Altitude, Radio Altitude, Radio Altitude Acquire, Heading Hold and Airspeed Hold operate in their respective axes individually or in a combination e.g. Barometric Altitude, Heading and Airspeed Hold can all be operated simultaneously. Transition and Cable modes require simultaneous control functions in pitch, roll and collective axes and Heading Hold mode would also normally be engaged.

All autopilot control signals are fed into the limited authority series actuators and also into full authority parallel actuators which operate to prevent series actuator saturation during autopilot manoeuvres.

All autopilot channels are duplicated in the collective axis but are simplex in pitch, roll and yaw axes.

The Equipment

Computer Acceleration Control
Houses the electronic modules and accelerometers required for the collective stabilization functions and lateral acceleration computing for augmenting yaw stabilization for utility version and possibly all other variants.
6¼" wide x 5½" high x 8¼" deep.

Computer AFCS
Contains the system logic, interface circuits, computing and actuator drive electronics. All circuits are contained on 6" x 4" printed circuit plug in modules. The computer houses 17 modules in ¾ ATR (long) package. System BITE facilities are also included within the main computer unit.

ASW Computer
Contains the electronic modules required for the ASW role and is used in conjunction with the main AFCS computer and the CAC unit to provide Radio Altitude Acquire, Transition and Cable (Angle and Height Control) modes. The computer houses 17 + 1 spare modules.
8¼" wide x 8" high x 11¾" deep.

Engaging Controller
Provides pilot control for the engagement of the total autostabilizer and the disengagement of each autostabilizer lane in each axis, also the engagement of each autopilot mode with the exception of the Cable and Transition modes. The controls for these modes are provided on a separate controller. Facilities are also provided for pitch, roll and heading trimming. All switches are illuminated on engagement.
5¾" wide x 5¼" high x 5¾" deep.

Test Controller
Is a cockpit mounted unit designed to provide a means of in-flight monitoring of the control signals to, or the position of, each series actuator. It is also used in conjunction with BITE to provide 1st line test facility for the system.
5¾" wide x 3¾" high x 9" deep.

ASW Controller
Provides facilities for engagement of Transition and Cable modes and the means whereby the pilot can select height acquire altitude, hover altitude and fore and aft, and lateral ground speed required at the completion of transition.
5¾" wide x 6¾" high x 5½" deep.

Parallel Actuators
Electromechanical actuators providing a rotary output of nominally ±60°, for autopilot functions. They are also controlled direct from pilot's stick switch in pitch and roll for trim adjustments in those axes.

Yaw Rate Gyros
The yaw rate gyro provides information for the Yaw Autostabilizer and a dc signal proportional to aircraft yaw rate.
3½" wide x 2¼" high x 5".

Stick Position Transmitters
Provides a signal proportional to cyclic stick position.
2" wide x 2" high x 5½" deep.

Summary of System Features

- **LIGHTWEIGHT** — 50-60 lbs depending upon system configuration.
- **SELF TEST** — Built in test equipment is included within the system for ground test and in-flight monitoring.
- **HIGH RELIABILITY** — System MTBF in excess of 1000 hours.
- **MAINTAINABILITY** — Modular construction providing a system which can be easily serviced and maintained in the field.

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