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Honeywell Primus EPIC[TM]
Integrated Avionics System

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Helicopter Industry Requirements

What are the requirements for a future helicopter avionics system? Honeywell talked with many helicopter manufacturers, operators, pilots and support personnel to get their inputs to this new avionics system design. Helicopter operators in all segements including military, EMS, offshore oil and corporate have different requirements and problems to be solved. Thus the system needs to be flexible and adapable.

Here are a few of the inputs that Honeywell received:

- Must be low cost, 30% lower in cost than today's avionics, for the same functions.
- Should be able to expand to host new functions of the future (CNS/ATM).
- One set of hardware that can be used across all models and versions of the helicopter (EMS, Corporate, SAR, utility, military, etc.).
- Should be able to integrate other federated functions including aircraft utilities, HUMS, etc.
- Easy to learn and to operate new functions, to reduce training of flight crews and maintenance personnel.
- Must meet the more harsh helicopter operating environmental conditions.
- More reliable, by at least 200%. MTBF measured in years, not hours.
- Easy to troubleshoot and return to service. Reduce helicopter down time (15 minutes).
- Reduced operating costs, spares costs.

Changes in Technology

Many of the things that customers wanted avionics to do in the past were not possible due to three limitations:

Display technology which used CRT devices that were limited in what they could display and still meet sunlight readability requirements.

Processor limitations which restricted the type of integration capabilities that the overall aircraft required.

Memory storage capacity to handle the vast quantities of data which included terrain, maps, charts, navigation data plus documentation such as aircraft manuals.

These limitations have been removed with the use of modern Commercial Off The Shelf (COTS) devices from the consumer PC industry. The challenge has been to take these COTS components and certify them to meet various FAA/JAA requirements. This involved development of a new operating system and data bus architectures.

Primus Epic, Honeywell's Next Generation Integrated Avionics System

The Honeywell design team that developed this new avionics architecture had several members with extensive helicopter experience. Thus it is no surprise that the design fits exactly what the rotary-wing industry required in a future avionics package.
This revolutionary new integrated avionics system is Honeywell's response to the industry's request for lower cost and higher reliability components as well as flexible architecture that easily permits customization to meet end user requirements.

Starting with a review of the entire end-to-end process of operating and servicing the aircraft, as well as mapping the information exchange that occurs between the entire flight team of pilots, dispatchers, air traffic controllers and maintenance technicians, Honeywell designed a system to provide seamless execution. Honeywell worked closely with Honeywell's Technology Center, the FAA, NASA and many operator advisory boards to ensure that the design utilized the latest concepts that addressed specific issues with today's and the future operating environment.

Honeywell is in a unique position to take commercial off-the-shelf (COTS) devices and integrate them into the aircraft while meeting the exacting requirements of the aircraft environment and certification mandates. COTS devices, such as processors, LCD flat panels, and high speed bus hardware, ensure that the latest technology is available at the lowest cost. The design of the Primus Epic system permits upgrades to the system hardware or software, with no impact or re-certification of other elements in the future.

Primus Epic is an open architecture design, with Honeywell providing both software and hardware development kits to outside parties to integrate their functions into the system. Already several companies have developed functions for Primus Epic system applications. For example, a supplier of fuel quantity systems has developed a module that takes the unique fuel sensor inputs and provides fuel quantity information to all the other Primus Epic functions in the aircraft for processing, display and other calculations.

A modular design permits the system to be configured to fit the turbine helicopter market as well as twin turboprop to regional jet commuter market, plus the entry level light jet up to the new long range global business jet segment. This is the first time that the helicopter segment has been able to take full advantage of the hardware and software available to other aircraft types. Any function available to the regional airlines or business jets, is now available to the helicopter operator. For example, up-linked weather information, electronic charts and maps, integrated maintenance and troubleshooting.

Modules have very high reliability goals and can be easily replaced by the operator in the field. Additional modules can be added when new functions or regulatory requirements exceed the current capability of the system. Modules and additional software functions can be added in the field to accommodate new mission requirements or assigning the helicopter to a new market. Common modules, with other Primus Epic systems, reduces the type and number of spares required. For example, any processor module can be used in a helicopter or fixed-wing installation.

The new Human Centered Cockpit Design uses a Cursor Control Device and pull down on screen menus to permit the crew to interface and control the aircraft at a higher level of interaction that in today's cockpits. Displays are LCD "flat panels" that provides new capabilities not previously available in today's civil aircraft. The aircraft can be configured with a few as two or as many as six displays.

Safety enhancements include better situational awareness by providing aircraft present position integrated on an electronic chart which includes terrain avoidance information. Weather images, from ground based radar or from satellite sensors, provides the crew information about conditions far ahead of the aircraft along the planned route. This electronic data link with the ground is only the first step toward CNS/ATM, and Free Flight that can easily be accommodated in the new Primus EPIC system.

Currently the Primus Epic hardware and software continues in development. First deliveries of prototype units has started, and flight testing on Honeywell's company aircraft has been ongoing for more than two years. Some elements, such as the unique DEOS operating system have already been certified by the FAA and other agencies. Environmental testing, including HIRF levels has

started. All of the Primus Epic hardware was designed to the helicopter environmental requirements from the very beginning.

Primus Epic, soon to be flying on the AB-139 helicopter, Fairchild-Dornier 728 and Embrarer 170 regional jets and the Raytheon Hawker Horizon.