Defence Science Journal, Vol. 63, No. 2, March 2013, pp. 129-130, DOI: 10.14429/dsj.63.4269

Guest Editorial

AVIONICS SYSTEMS

'Avionics' systems, over the decades, have grown from simple communication radios and navigation equipments to complex integrated equipments primarily infiuenced by dominance of digital technology. Continuous growth in integrated circuit technology, functional integration of complete system on chip, very high speed communication channels and fault tolerant communication protocols have brought remarkable advancements in avionics systems. Further Mechanical and Pneumatic functional blocks are being replaced by digital systems progressively and decisively. New generation aircraft are being built around powerful avionics assets to provide stress free cockpit to the pilot.

The growing complexity of military environment is constantly redefining avionics system requirements. Increase in situation awareness and survivability has placed special demands on avionics systems leading to development of new architectures and standards. Migration from federated architecture to modular, integrated and open architecture has resulted in quick adaptation of fast changing requirements. It has become essential to control cost through innovative architectures and integration of functions. Sharing of resources onboard and off-board has become mandatory to keep volume, weight and cost under control. Standards have emerged defining principies for robust partitioning of functions. Usage of COTS components and technologies has become essential to reduce development time and also ease the certification process.

Point-to-point communication replaced with multiplex buses, independent displays replaced with multifunction display has redefined avionics environment. Display of information in coherent and collective form has enhanced pilot's perception of the situation. Fault tolerance and graceful degradation has become inbuilt feature of current avionics system and thus enhancing pilot's confidence in flying the machine. Tactical links and networked resources is making modern military aircraft more information intensive and need for built-in intelligence in avionics systems is emerging as a requirement.

The fifth generation avionics for the fighter aircrafts are being designed to gain new tactical advantages through enhanced maneuverability, multi-role capabilities and thereby giving the aircraft domination in the sky. The use of more flexible and lighter structures for airframe may demand more complex control algorithms and faster response time.

Reconfigurable architecture, with a facility to move applications from faulty resource to functional resource will provide improved operational reliability while confirming required operational safety.

It is necessary for the Indian defence industry to recognize above on-going developments in avionics across the globe and gear up to absorb new technologies to become self-reliant in this critical domain.

However it is an established fact that Indian defence organisations have made substantial progress in avionics in tenms of system development, integration and evaluation meeting the needs of Indian Armed Services. *Defence Science Journal* has planned this Avionics special issue providing an opportunity for the avionics industry from the defence sector to share their experience and the views. The topics coverage for the technical papers were widely identified and the special issue contains seven research papers, four review papers and two short communication notes. In addition the special edition has come out with two invited papers from eminent avionics leaders in DRDO.

First invited paper on 'Advanced navigation system for aircraft applications' provides details on the indigenous development of an aided navigation system based on ring laser gyro of 0.01 deg/hr class and GPS - GLONASS to further enhance the capability of system in terms of accuracy.

Second invited paper on 'Microwaves in airborne surveillance' describes the usage of microwaves in airborne surveillance systems, in general, and in the Indian airborne early warning and control (AEW&C) System, in particular.

In view of the brief on the technical papers, the first paper is on the 'Fusion of on-board sensors for better navigation' which explains the importance of fusing of various navigation sensors such as inertial navigation system (INS), global navigation satellite system (GNSS) and TACAN sensors available onboard to provide increased availability of the navigation data.

Second paper 'Stroke symbol generation software for fighter aircraft' describes the generation of the critical head-up-display symbology in the cockpit that minimizes the pilot overheads for flying. Further in the paper titled 'Integrated enhanced and synthetic vision system for transport aircraft', the indigenous development of new avionics concept called integrated enhanced and synthetic vision system (IESVS) is described, which enables flight operations during adverse visibility conditions.

The mission computer being the main heart of the avionics, two papers have been concentrating on the same. In the paper titled 'Flight test evaluation of mission computer algorithms for a modern trainer aircraft', the techniques for evaluating the mission computer has been focused and in the paper titled 'Making the mission computer intelligent – A step ahead', the techniques to make the critical mission computer as a pilot associate that immensely increases the situation awareness to the pilot has been elaborated.

There are two papers which have focused on some modern innovative techniques for weight reduction and enhanced methods for communication The paper titled 'Communication management unit' provides solution for combining both audio and data to the pilot over a common system and in the paper titled 'Wireless data acquisition system for launch vehicles', the implementation of the wireless data acquisition techniques has been elaborated.

To offset the ever increasing volume occupied by Avionics in the aircraft, the paper titled ‘A blue print for the future electronic warefare suite development’, brings out the latest techniques of IMA architecture applied to the critical EW systems to reduce weight and volume.

The next two papers focused on core algorithms for improving the performance of the most significant EW systems in Avionics. The paper titled ‘Approaches towards implementation of multi-bit digital receiver using FFT’ explains the signal processing schemes for the current ESM systems. The paper titled ‘Approximation and filtering techniques for navigation data in time-critical electronic warfare systems’ has focused on optimization techniques for improving RWR system performance.

The last three papers have focused on the significance of improving the software and hardware utilization in the avionics systems. The paper titled ‘FPGA implementation of splitradix FFT for high throughput’ explains the methods for improving the FPGA implementation as most of the modern avionics system implementation are based on firmware solutions. The paper titled ‘System software abstraction layer much more than OSAL’ has detailed a versatile method for making the SW centric avionics system more reusable and reliable. The paper titled ‘ARINC 653 API and its application -An insight into avionics system case study’ has explored SW centric avionics systems development through the latest ARINC 653 standards.

At this moment, it is my inherent duty to acknowledge the efforts put in by the reviewing experts from various defence establishments and the Technical Selection Committee who has spared their valuable time in finalizing the technical papers for the special edition. Also I am thankful to the Editorial Team of *Defence Science Journal* and to all the authors of the technical papers. My special thanks are to Smt R. Pitchammal who has contributed immensely towards the success of this effort.

P.M. Soundar Rajan
OS & Director
DARE, DRDO
Bangalore

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