At the Aerospace Electronics and Systems Division of CSIR-NAL, research along with product D&D is carried out in four major disciplines: Civil Aircraft Avionics and Embedded systems, Systems Engineering, Software Engineering and Micro Air Vehicle and Signal Processing. The prime objective of the division is to address the civil aircraft activities for CSIR programs in particular and general aviation, regional class of civil aircraft in general.

Innovative Systems Technologies is the driving force behind all the research and development activities. Critical functional expertise are Avionics architectures, systems and software engineering, formal methods, Active Noise Control, IMA based open architecture systems, Radar and signal processing, Aircraft flight data analysis system, MAV technologies like Vision based navigation and Embedded 9DOF MEMS digital sensor based micro electronics for MAV autopilot.

**Expertise**

- Systems Engineering for Avionics, MAV and embedded micro-electronics
- Software Engineering for highly safety critical systems and formal methods
- Signal processing for Active Noise Control and Radar
- Vision aided flight guidance and navigation
- Advanced Avionics Architectures
- ARINC 653 based IMA system design and Model based D&D
- Innovative MAV micro electronics payload
- Civil certification and qualification of avionics systems

**Major Programs**

- FAR 25 class avionics suite for General Aviation civil aircraft
- FAR 25 class Avionics architecture for regional transport aircraft Systems
- Indigenous D&D of IMA, SWS, EFIS, EICAS and AFCS systems for general and regional class
- Vision based navigation for MAV and radar signal processing
- Embedded Micro Electronics for MAV
- Flight data analysis and software D&D for airlines operators as part of FOQA
- Active Noise control for pilot helmet, Baby incubator
- Smart and Enhanced Fatigue Meter
Systems Engineering

Systems Engineering activities of the division is concentrated towards the design, development, integration/testing and certification of flight critical systems like Integrated Modular Avionics Open Architecture Systems with state of the art technologies like ARINC 653 and ARINC 818, Advanced Display Systems, Engine Indication and Crew Alerting System, Configurable display system with integration of EICAS, PFD and ND.

Integration of reconfigurable SARAS display system

Expertise and NextGen programs

Major NextGen programs towards realization of products and high-end research in the field of
- Integrated Modular Avionics (IMA) and ARINC 653 based Integrated Model Based Design and Development (IMDD) for aerospace application
- Single platform solution from Concept to Airworthy product using innovatively integrated tool based automation and seamlessly coordinated transfer of artifacts
- Advanced AFDX, ARINC 818 and Symbology Evaluation and integration facilities
Software Engineering

The focus of this domain is to foster an environment of excellence for exploration of state-of-the-art software engineering technology for civil aerospace applications by continuous process and product improvement, software engineering metrics and infusion of software engineering research and technology.

Expertise

Software Engineering domain has expertise in design, development, Independent Verification and Validation (IV&V), LLI, HSI and system testing of flight critical DO 178B Level A software to civil aircraft applications.

With the demanding scope of DO 178C, the application of Formal Methods with the adoption of Model Based approach for software has been the area of concentrated focus.

Expertise of DO 178B has been applied to various Level A critical software applications for civil and military programs. Hence the process, methods and procedures are well defined for application to other programs in India.

(Micro Electronics for Micro Air Vehicle)

State of the art embedded micro electronics hardware for Autopilot using Programmable System on Chip (PSoC). The Autopilot hardware is integrated with MEMS 9 DOF sensors (Accelerometer, magnetometer and Gyros).

Division is aimed at design and development of low weight autopilot hardware in series of boards from 6.5 grams to 20 grams including 9DOF sensors.
Active Noise Control

Active Noise Control (ANC) system for fighter aircraft pilot helmet, Multichannel ANC system for Cabin noise reduction, Vision based system for navigation of MAVs in GPS denied environments and Communication for heterogeneous system of vehicles Cockpit Voice Recorder analysis are few of the key achievements.

Signal Processing

The expertise in signal processing are Signal processing solutions in the development of Aircraft systems, DSP methods as applied to flight guidance and navigation of Micro Air Vehicles, Real-time algorithm development capability on microcontrollers and state of the art DSP processors, Novel algorithms for joint time-frequency methods and multi-resolution techniques for signal analysis.

Calibration Standards

Calibration standards facility at the division caters to the calibration needs of Aircraft avionics systems, various measuring instruments and sensors used across the laboratories for voltage, current, temperature, pressure.

International Collaborations

Division has international collaborations with M/s Astronautics, USA, M/s Astronautics, Israel, M/s CAE, Canada, M/s CMC and Quebec Canada and M/s Precilec, France.

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