

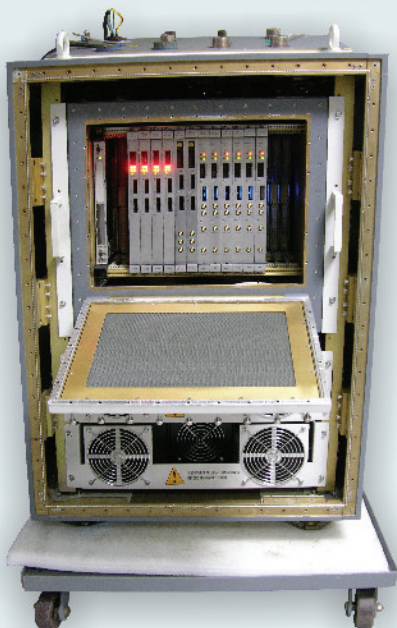


Programmable Signal Processing Unit - System Development and Integration

Introduction

Recent trends show Indian Defense labs moving from sourcing diverse components from multiple vendors to acquiring complete, integrated solutions from a single vendor... paving the way for systems integration - a systematic methodology used to develop a wholly integrated system composed of diverse specialized structures and sub-systems.

Having a resource to provide the complete solution helps end users free internal resources to focus on their core area i.e. designing their application and getting their product-to-market faster. This case study showcases Mistral's expertise in the system integration of a Programmable Signal Processing solution... from evaluating the customer needs and expectations to producing an optimum solution custom-made to fit the specified requirements.



“ Mistral's expertise in high speed designs and allied system design helped in providing a customized expandable signal processing solution in a single 6U VME form factor to suit the customer's radar signal processing needs. ”

The Customer

A leading Defense Lab in India approached Mistral to build a Programmable Signal Processing unit for Radar.

The Requirement

The customer's requirement was to develop a system consisting of:

- Complete hardware housed in a single rack
- System wiring: both internal and external based on the input-output sub-system requirement
- External interface: real-time inputs to the intelligence system to dynamically change the functionality
- Data Acquisition: two independent ADC channels sampling at maximum of 65 MSPS, with ENOB of 11 bits and SNR 66dB
- Processing sub-system:
 - Processing unit with a total of 30+ GFLOPS processing power
 - Processing distributed in various nodes and capability to expand
 - High-speed data connectivity between processing nodes and data acquisition system
- Output sub-system:
 - PowerPC based high-speed system to output real-time data after processing
 - Future expandability to output recorded data.

The Solution

Mistral provided a solution consisting of:

- 6U single rack assembly designed to house hardware with a VME backplane
- Standard wiring assembly from an approved vendor, to cater to the design requirements
- Real-time OS (VxWorks) running on VME based SBC from Curtiss-Wright (SVME 183) used for external interface
- Data Acquisition hardware using Mistral's VME based ADC Board:
 - One ADSP 21160 SHARC DSP from Analog Devices for data processing capable of 480 MFLOPS performance
 - 4 M-bits Flash memory with 4096x36 bit FIFO
 - Dynamic DC offset control and other programmable options with 200 Kbytes SPARTAN 2 FPGA
 - Operating temperature range: - 20°C to +55°C

- Processing sub-system using Mistral's VME based 12 SHARC (V12S) Boards:
 - 12 ADSPs in a single board. Using multiple V12S boards the 30+ GFLOPS performance was easily achieved
 - Data to be processed was distributed evenly across processors by receiving data from acquisition cards, making use of the complete system processing power
 - Connectivity across nodes on the link ports on board and across boards
 - Connectivity of each processing board in system with data acquisition system on link port
 - Other features of V12S Board:
 - › 12 ADSP-21160 SHARC® processors from Analog Devices (ADI) for data processing with performance of 5.76 GFLOPS
 - › PMC site for expandability
 - › 64 Mbytes SDRAM and 32 Mbytes Flash memory
 - › Distributed link port architecture for point-to-point communication between DSP's with complete link port interconnectivity possibility and additional switching software
 - › 12 off-board Link ports: 6 at front panel and 6 at P2 connector for interfacing with Data Acquisition cards
 - › Operating temperature range: -20°C to +55°C
- Output Sub-system:
 - SVME 183 SBC from Curtiss Wright supports dual Ethernet ports of which one of the ports is dedicated for data output from the system
- Interfacing of system was done using cables of 5-6 inch length. Dummy boards and a Sandwich board (customized VME Backplane board for General Purpose Interface) were designed to achieve the data transfer length and avoid data corruption
- Dummy board features:
 - Buffers for data acquired to reach the processing sub-system
 - PMC slot for expandability to output recorded data
- Sandwich board features:
 - Connectivity of dummy board data to V12S Board (on P2 general purpose bus)
 - External interface connectors for wiring
 - Reduced external wiring and good signal integrity.

The Challenges

- Achieve data transfer length between data acquisition board and processing boards. Mistral's expertise of high-speed designs, and experience in designing an allied system aided in achieving this
- Design power supply and air flow requirement for boards in the rack. This was the first time Mistral had taken up a full rack design and was successful in conducting the analysis and providing inputs to the vendor
- Interface boards with customer boards and perform integration tests
- Develop a software on all integrated boards to test their functionality
- Stringent Acceptance Tests:
 - The Defense Lab had a series of tests before the system could be accepted
- Unit Test - for all individual equipment
- Integrated functional test
- Endurance test
- Environmental tests.

Key Achievements

- Flawless integration test of the system, meeting all system requirements
- Successful completion of all stringent acceptance and environmental tests as required by customer
- Porting of customer codes to SVME 183 and testing the full functionality of the system.

Customer Benefits

- Mistral was able to provide a customized and expandable signal processing solution in a single 6U VME form factor to suit the customer's radar signal processing needs
- The solution was made available through a single system integrator that not only provided the solution but also ensured support and maintenance
- The Heart of the system, Data Acquisition and Processing Sub-system was designed by Mistral, ensuring support for any future requirement.



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