

## Sonar Dome Monitoring System (SDMS)

**The challenge** To validate the design and the integration of the different components inside of the sonar dome of Italian Navy FREMM frigates.

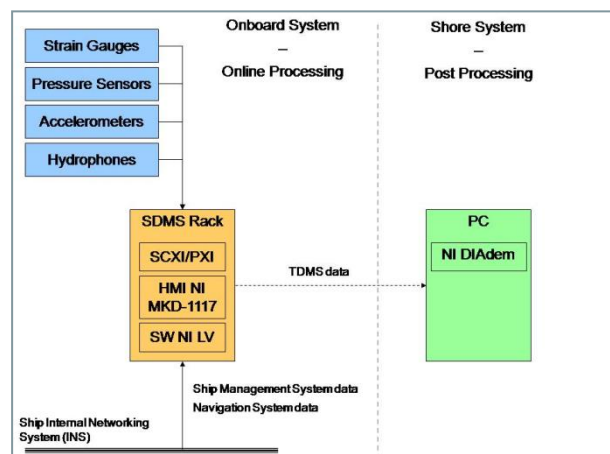
**The solution** To develop a Sonar Dome Monitoring System based on NI LabVIEW and PXI data acquisition system, able to collect and process on board all relevant data and a shore post-processing system, based on NI Diadem.

**Abstract** The SDMS main functions are:

- To collect data which will be useful to analyze the structural and vibrational behavior of the sonar dome and the elastic response due to hydrodynamics components during the ship's normal operations. System provides a first step of real-time elaboration, but deeper elaborations and cross-correlations will be analyzed with NI Diadem by using the recorded data set.
- To calculate the platform Self Noise.
- To evaluate the propagation of the machinery noise over the dome and its influence through recorded data and their successive analysis.

One of the main advantages of system architecture is that using TDMS data file format you can automatically relate, both in real time and in post processing, raw or processed data together with the vessel structure both in terms of attitude, speed etc. and in terms of propulsive attitude, RPM and propeller pitch.

**The Application** The Sonar Dome Monitoring System (SDMS) has been developed following the specifications made by Orizzonte Sistemi Navali (OSN), Prime Contractor for FREMM Frigates. The whole system was developed and integrated by CETENA and the LabVIEW online software was developed by SITEM. The SDMS architecture is described in the above scheme. Data acquisition system is based on a PXI/SCXI platform, including the following boards: 1 PXI-6251 general purpose data acquisition board, 4 PXI-4462 IEPE accelerometers data acquisition boards, 2 SCXI-1520 strain gage input modules. The SDMS is designed to record, even without the presence of a dedicated operator, all relevant structural and acoustic



**Sitem** nasce a Genova nel 1999 da un gruppo di professionisti, accomunati da una forte competenza ed esperienza nel settore ingegneristico e informatico con la voglia di creare un nuovo punto di riferimento, orientato al mondo del Test e della Misura. Oggi la soddisfazione di lavorare a

stretto contatto con importanti realtà industriali italiane e straniere, rappresenta il motivo per cui, a distanza di più di 15 anni, continuiamo ad accettare le sfide difficili che ci vengono poste.

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parameters of the sonar dome that can occur during ship operations in order to allow a validation of the integration of the different components inside the dome, without generating too much data. The SDMS operating modes are the following:

- Not Assisted mode: in this operative mode the SDMS SW checks some significant incoming signals in order to detect the start/stop recording triggers depending upon the set threshold values.
- Assisted mode: the threshold real-time evaluations for triggering are disabled. User can decide whether to start or stop manually a recording session. User can also manage recorded data.

SDMS manages the data acquisition mainly in three ways:

- 1) DAQ Analog Input data acquisition: signals coming from NI data acquisition boards are acquired, analyzed and stored directly by the application;
- 2) OPC data acquisition: OPC signals are acquired through a TCP/IP connection and an Ethernet network connected to the Ship Management System (SMS). These signals are relative to some SHIPs machinery such as DGs RPM, propeller pitch or other equipment status;
- 3) UDP data acquisition: these signals are collected through an Ethernet network from the navigation system.

All recorded data are saved in TDMS file format. Being this an open architecture, this allows users to inspect data with many data analysis software (for example NI Diadem). TDMS file may contain raw data, OPC, UDP and accelerometers FFT waveforms and calculated channels.

SDMS HMI consists of a set of views devoted to given tasks grouped on the basis of homogeneous functions. The homepage "Overview" is the entry point to the SDMS capabilities each one managed by its own SW module. Namely:

- Continuous data acquisition, synthetic calculations, spectral analysis,
- Data Recording,
- Data Retrieving.

SDMS HMI provides a fixed header on the top of the screen, which also provides the real-time value of some fixed OPC and UDP signals coming from NAVigation System (NAVS) and Ship's Machinery. The center of the screen provides dynamic subpanels which will be called by the user.

