

# 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 (SDMS), 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.

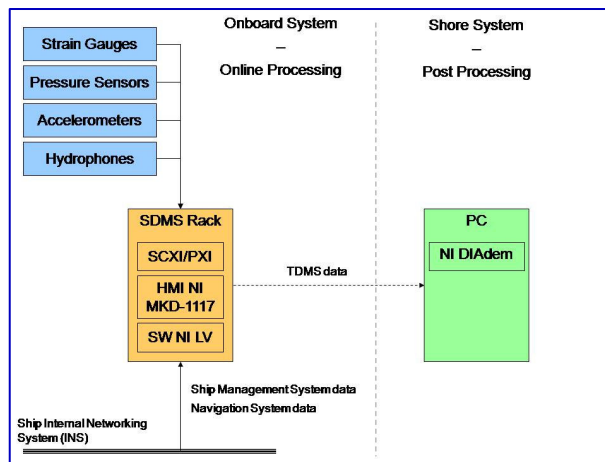
One of the main advantages of system architecture is that using TDMS data file format (see below) you can automatically relate, both in real time and in post processing, raw or processed data together with the vessel structure both in terms of attitude, speed etc. and in terms of propulsive attitude, 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: 1 NI PXI 8110 controller, 1 PXI 1050 chassis, 1 PXI-6251 general purpose data acquisition board, 4 PXI-4462 IEPE accelerometers data acquisition boards, 2



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**SITEM** si offre sul mercato come *System Integrator* in grado di implementare applicazioni PC based, garantendo soluzioni flessibili che portano il dato dal campo direttamente all'operatore, assicurando la mobilità ed esportabilità del dato stesso.

**SITEM** è *Alliance Member* di National Instruments e fa parte del consorzio *Profibus Network Italia (PNI)*.



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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 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.

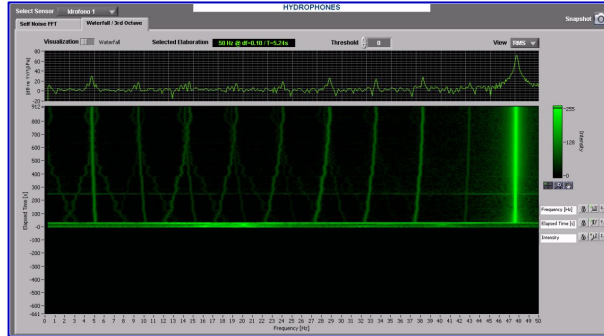
All recorded data are saved in TDMS file format. Being this an open architecture, this allows users to inspect data with many data analysis software (for example NI Diadem). TDMS file may contain raw data, OPC, UDP and accelerometers FFT waveforms and calculated channels.

SDMS HMI provides an easy to use graphical interface to manage the acquisition and processing aimed to manage tasks foreseen by requirements. HMI consists of a set of views devoted to given tasks grouped on the basis of homogeneous functions. The homepage ("Overview") is entered as the operator evokes the SDMS program. It 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.

For more details, please feel free to contact us.



## Software

LabVIEW  
Diadem

## Hardware

PXI 8110 controller  
PXI 1050 chassis  
PXI-6251 data  
acquisition board  
PXI-4462 IEPE  
accelerometers data  
acquisition boards  
SCXI-1520 strain  
gauges modules

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