

**Sistine Chapel •  
HVAC •  
EdgeTech Dew Point Transmitter •  
Reliability Requirement •**

*“.....the environment of 55% humidity must be scrupulously maintained. Once you push the button, the system must work forever.”*

Stefano Marino, Vatican Engineer  
National Geographic

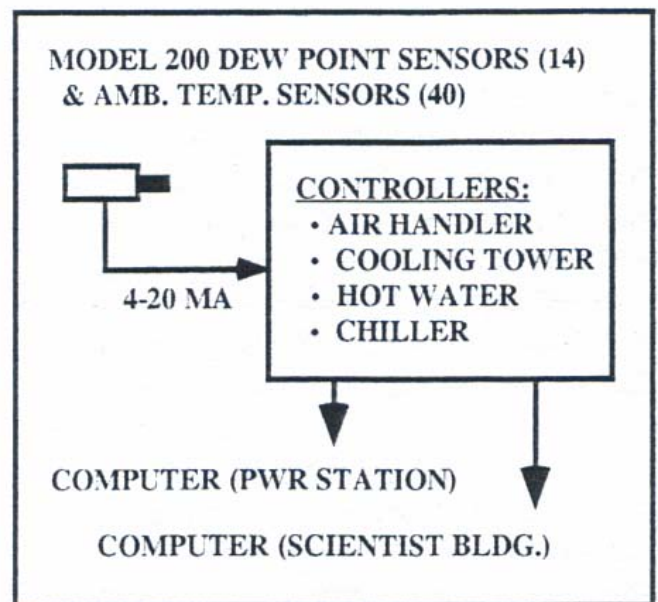
## Background

Preserving Michelangelo's frescoes in the Sistine Chapel for future generations to enjoy became an important goal of the Vatican in the early 1980's. The restoration of the wall and ceiling frescoes and their continued preservation required technical intervention to control the interior environmental conditions.

## The Challenge

The Carrier Corporation (Farmington, CT), the world's largest air conditioning equipment manufacturer, was given the challenge to design and install a humidity control system for the Chapel. Carrier selected three criteria for the humidity device to be used in their control system

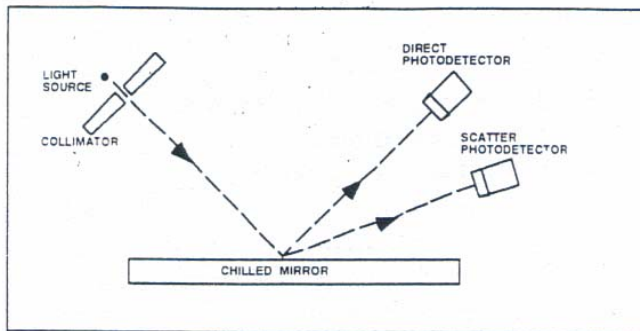
1. The humidity measurement needed to be accurate.
2. The humidity instrument needed to be reliable because access to the instrumentation would be limited. The specific equipment requirements included:
  - a. Few moving parts
  - b. Maximum time between maintenance
  - c. Easy to maintain
  - d. Ability to compensate for the effect of contamination



3. The equipment needed to be non-intrusive, minimizing any visual impact on the frescoes.

## The Solution

After an extensive evaluation, Carrier selected the EdgeTech Model 200 DewTrak™ transmitter as the best technology to provide a solution. Carrier reviewed the various technologies from thin film (capacitance) to optical chilled mirror. They selected optical chilled mirror for the direct measurement of absolute (vs. relative) humidity. Chilled mirror is a primary measurement rather than a calculated or inferred measurement. The Carrier-selected EdgeTech DewTrak™ sensor incorporates a polished metallic surface (the mirror) that is cycled between heating and cooling, allowing condensation to form a dew layer.



The presence of dew is detected electro-optically by reflecting a highly collimated light source (LED) at an angle off the mirror surface, and then measuring the reflectivity with a photo detector. A full transmission is detected when the mirror is heated to dry conditions. Less than full transmission is detected when the mirror is cooled to the condensation dew point.

A platinum resistance thermometer is embedded beneath the surface of the mirror which measures the mirror temperature. Any change in dew point is automatically tracked by a feedback control circuit which maintains the equilibrium dew layer.

The EdgeTech DewTrak™ transmitters are located high on the Chapel wall and ceiling. As such, special permission is required to perform routine maintenance. Dust generated from the frescoes, foot traffic and the outside environment may collect on the mirror over time. The transmitters employ an optical scheme to compensate for contaminants, reducing the need for maintenance. The EdgeTech Model 200 transmitters use a relay to feed back a signal that the sensor requires service, if necessary.

The third requirement of Carrier was that the units remain inconspicuous in the Chapel. The Vatican insisted that the view of the newly renovated Chapel not be impaired. The size of the DewTrak™ package is sufficiently small, enabling the units to fit on a ledge 30 feet off the ground. Others are installed in the ceiling itself.

The success of this application demanded a clear analysis of the problem, solid technical solutions and a good partnership between the user and suppliers. For the companies involved, controlling environmental conditions within the Sistine Chapel represented a technical challenge with deep historical implications. Not unlike the frescoes, the project had little room for error.