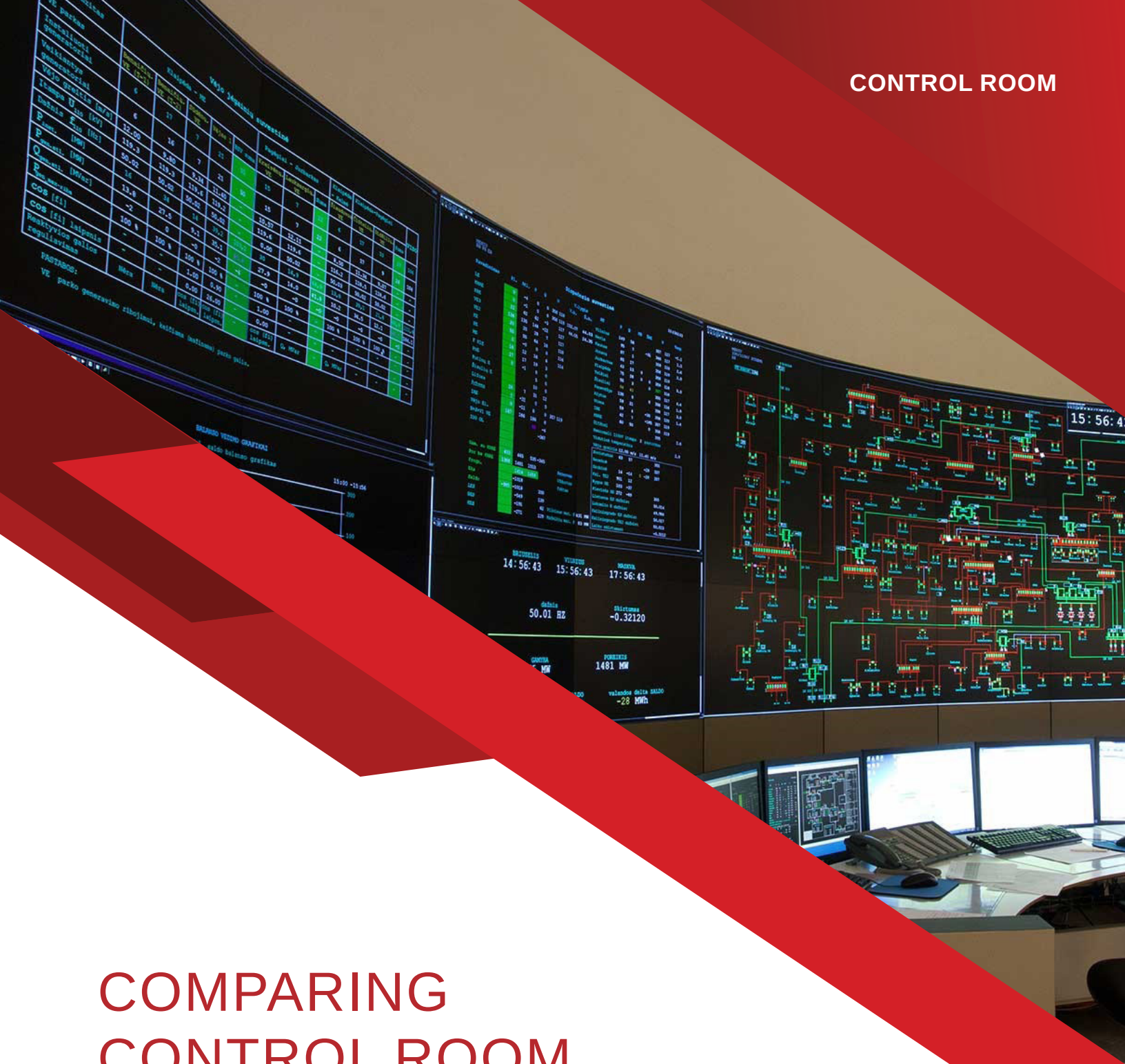
CONTROL ROOM



# COMPARING CONTROL ROOM DISPLAY TECHNOLOGY

Display Solutions for Mission-Critical Control Room Operations

PLANAR®


# Evaluating Video Wall Technology for Control Rooms

For more than 30 years, Planar and eyevis, have provided innovative visualization systems to customers in a variety of control room vertical markets worldwide including Broadcast, Government, Security, Telecommunications, Transportation and Utilities.

The combined installation base of Planar and eyevis position the company as a key player and a specialist in the control room market for all three major video wall technologies in this environment, including rear projection, tiled LCD and direct view LED.

This document will review the quality of each display technology in relation to the major requirements for a successful control room project, then review specific requirements for each of the major control room vertical markets.

# General Control Room Requirements

Control Rooms monitor and control various processes, applications and networks. In most applications, Control Room operators are responsible for recognizing potential problems and initiating responsive actions. The return on investment for a control room video wall is correlated to the fulfillment of a set of key criteria, and a few details can easily determine the success or failure of a project.

For example, the size of the characters relative to the operators' distance are to be carefully considered when designing a control room environment according to ergonomic principles. The choice of the right video wall display technology is a major decision, but also, for a given technology, the video wall design has to provide the standard of quality that will make a control room project successful in the long-term. The most valued features for control room video walls include:

- High reliability and a high level of redundancy. This implies either redundant power supplies, redundant light sources, redundant source connection and/or failover scenarios for any type of failure
- An extended lifetime and low cost-of-ownership
- A very good image uniformity from any angle, and minimum separation between displays
- Picture quality and precision, to ensure no loss of pixels containing information
- A high resistance to image retention, as applications will typically involve static images being displayed 24x7x365
- A low power consumption, heat dissipation and minimal noise at the display is important for 24x7x365 applications
- A small footprint in environments for control rooms with space constraints
- The success of a control room project also relies heavily on the supplier's experience with control room installations and their ability to provide local support, turnkey solutions with processing hardware, consulting, project management and qualified 24x7 technical support

## VIDEO WALL TECHNOLOGY OVERVIEW

### Rear Projection

Assembly of cube enclosures, each containing a digital projector projecting onto a screen from the back. All rear projection video walls involve a DLP® projector that creates an image using a digital micro mirror device (DMD), which contains a matrix of microscopic mirrors.

### Tiled LCD

Assembly of LCD monitors featuring ultra-narrow bezels. Current models of LCD monitors have long lasting LED backlight illumination and extreme narrow bezels down to 1-2mm.

### Direct View LED

Video wall made of an array of Light-Emitting Diodes (LED) as pixels. The LEDs are assembled on PCB boards called modules, which together create a truly seamless canvas.

***Litgrid AB*** *—Vilnius, Lithuania*
*Clarity Rear Projection Video Wall (12x3 of 67")*

# Rear Projection Video Walls

Rear projection is the historical video wall solution for control rooms. It has benefited from many improvements over 20 years of existence and is now a very mature technology. Among the critical milestones of the evolution of rear projection that are now widely accepted as absolute standards, Planar firsts include:

**1997**

*First DLP® rear projection video wall by Planar (formerly Clarity Visual Systems)*

**2000**

*The first front-service rear projection video wall display by Planar*

**2009**

*First LED-lit rear projection video wall by eyevis*

## Quality Matters

Combining nearly seamless separation between the displays, no image retention and a very good stability for 10 years or more with minimum maintenance costs, LED-lit DLP® rear projection fits control room market requirements. However, the available rear projection offering is vast and the prices may vary by twice as much for models that look similar on paper. Attention must be paid to details that may impact the user experience, for example, the front screen element and the quality of the projection engine that greatly impact the value of the solution.

***For instance:***

- The quality of the front screen, and especially screens with a very narrow vertical half-gain angle (down to 10°) that deliver poor uniformity
- Projectors using warping algorithms to align the projected image on the screen, resulting in interpolated pixels and blurred image

| PERFORMANCE COMPARISON | | |
|---|---|---|
| | **Rear Projection** | **Planar Rear Projection Solutions: *eyevis 2004, SLIM and TRP Series*** |
| **High Reliability and Redundancy** | **Good**: DLP® LED-lit rear projection cubes are usually stable and long lasting | **Better:** All eyevis rear projection video wall displays involve specific features aimed at providing redundancy of the light source:<br>• Redundant cluster LED illumination with heat pipes (no liquid cooling, no moving parts)<br>• Color rescue control (CRC) technology to ensures usable images in case of the failure of one primary color |
| **Extended Lifetime** | **Good:** DLP® LED-lit rear projection usually stable in time | **Better:** LED driving data logging for preventive maintenance (PMDL) |
| **Image Uniformity and Bezel** | **Variable**: Relies on the cube design and the front screen quality | **Good:** Very high quality screen with good horizontal and vertical viewing angles. 0.3mm bezel |
| **Picture Quality and Precision** | **Variable:** May involve warping algorithm and interpolation | **Good:** Pixel-perfect images on the whole range |
| **Resistence to Image Retention** | **Perfect:** No image retention with DLP® | **Perfect:** No image retention with DLP® |
| **Power and heat** | **Good:** Rear projection cubes have usually a good power efficiency | **Better:** eyevis TRP Series prevails with power consumption of just 63 watts per cube |
| **Small Footprint** | **Variable:** Most rear projection installations are rear service, although front service models are available with a reduced footprint | **Better:** eyevis SLIM Series has the smallest footprint and can even be mounted directly on a wall |

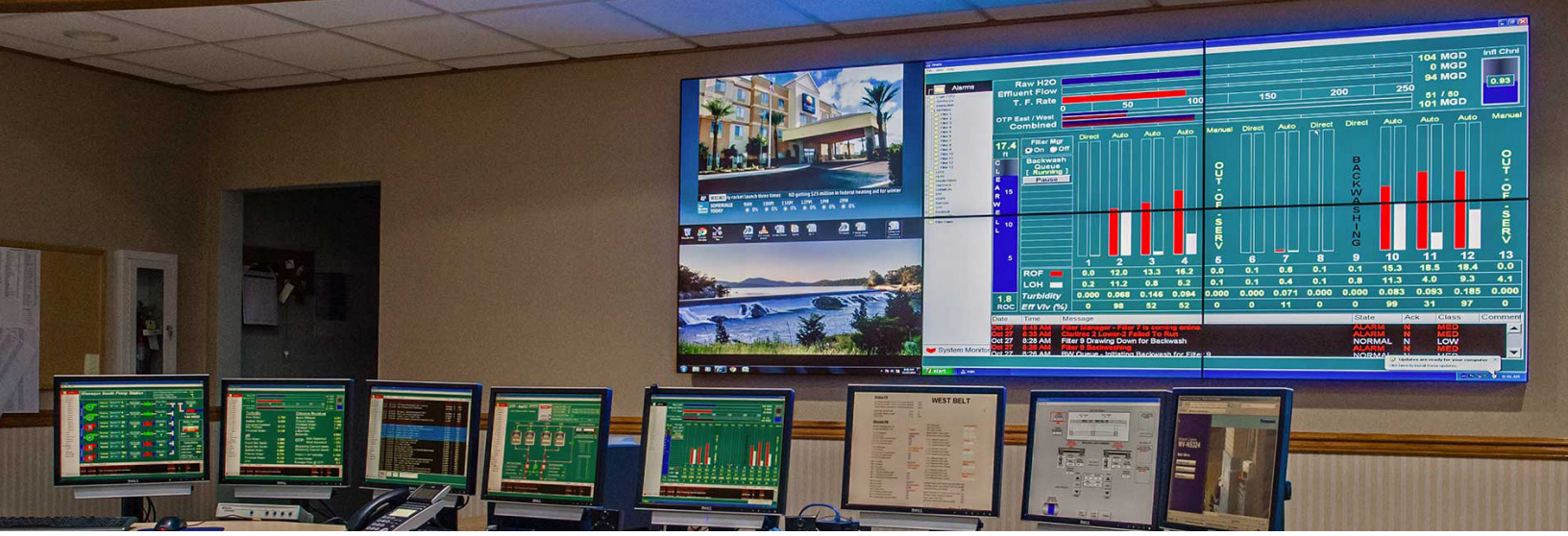
## Time to Upgrade

Rear projection is the most widely represented technology in existing control rooms and benefits from very affordable upgrade solutions. A rear projection video wall can be renewed by simply changing the projection engine to the latest LED-lit technology.

This solution is both cost-effective and less disruptive for control room operations, since the existing video wall does not need to be completely dismantled.

Planar offers an affordable upgrade solution involving the latest Texas Instrument DLP® TRP technology for over 50% power consumption saving.

*eyevis TRP Engine's small factor fits inside almost all cubes enclosures; Single module all built-in, including geometrical adjustments*



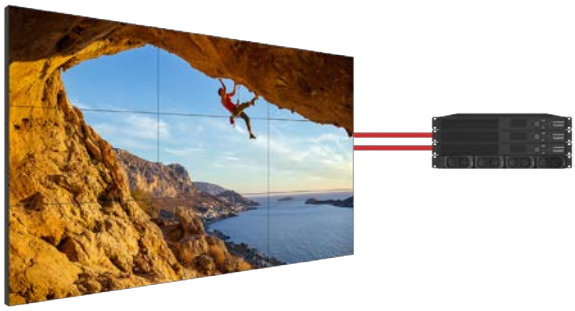
***North Jersey Water Supply Commission —*** *Wanaque, NJ, USA*
*Clarity Matrix LCD Video Wall System (3x2 of 46")*

# Tiled LCD Video Walls

Since it's introduction in the late 2000s, tiled LCD has proven to be a viable video wall solution for control rooms. The main benefit is simplicity to implement and service, as well as its small footprint. Major disadvantages are larger bezels and a shorter lifetime. The power consumption for tiled LCD per sqm and for a given brightness is higher than the other video wall technologies. This is inherent to LCD technology where LED backlight is filtered by polarizers.

## Off-Board Electronics Design

Since its public launch in 2009, the Clarity® Matrix® LCD Video Wall System's advanced design seeks to make the best of the tiled LCD technology for control room applications. Thanks to its external power supply and video controller, the advanced design of Clarity Matrix addresses most of the concerns with LCD technology for control room applications.



*Clarity Matrix architecture involves an external hot-swappable power supply and video controller, removing heat, weight, depth, noise and points-of-failure from the video wall.*

## PERFORMANCE COMPARISON

| | Tiled LCD | Planar Tile LCD Video Wall Solutions: *Clarity Matrix LCD Video Wall System* |
|---|---|---|
| **High Reliability and Redundancy** | **Bad:** Monitor design with no specific enhancements | **Better:** Redundant, hot-swappable power supply |
| **Extended Lifetime** | **Bad:** Image-wearing due to heat | **Better:** Less heat at the display thanks to the external power supply provides longer lifetime |
| **Image Uniformity and Bezel** | **Medium:** Not as good as the other two technologies. Relies on the precision of the 3rd-party mounting system | **Better:** Thanks to the Planar® EasyAxis™ Mounting System |
| **Picture Quality and Precision** | **Good** | **Good** |
| **Resistence to Image Retention** | **Bad to Medium:** According to the quality grade of the LCD panel | **Good:** Less heat at the display is key to fight image retention |
| **Power and Heat** | **Bad:** Power consumption per sqm for a given brightness is higher than the other two technologies | **Better:** Heat dissipation at the display is reduced with the external power supply being placed away from the control room |
| **Small Footprint** | **Good:** LCD are very shallow displays that can be wall mounted | **Best:** Planar EasyAlign Mount allows for no more than 10cm/4" of depth |


***Groupe TIRU Usine Systcom Isséane —*** *Paris, France*
*Planar® TWA Series (3x3 of 1.4mm)*

# Direct View LED Video Walls

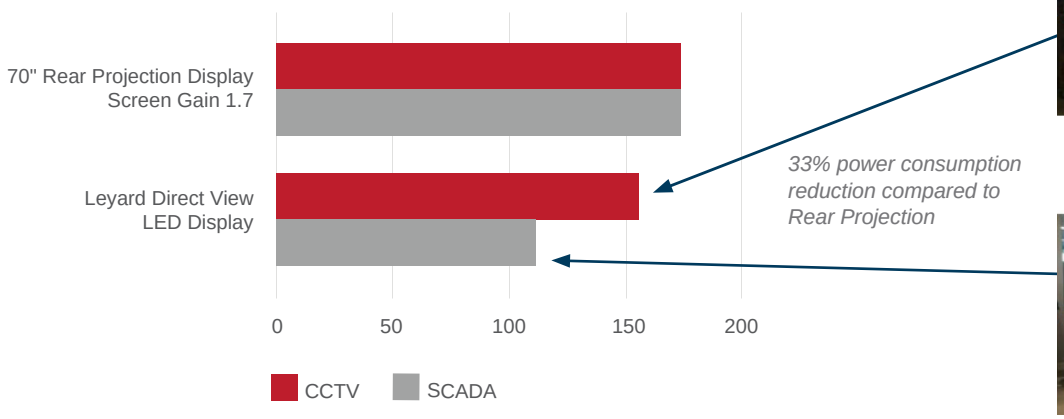
Direct view LED technology is gaining interest in the control room environment and is rapidly growing market share over the other two technologies. The main benefit of LED technology is the total absence of visible separation between the displays, providing a truly seamless and uniform video wall canvas.

## Power Consumption

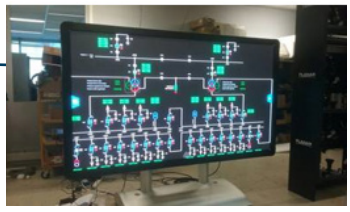
Power consumption (and heat dissipation) has long been a concern for LED video walls in control room applications, but the latest technology improvements, including driving LEDs with a common cathode, demonstrate that LED technology can in fact have a better brightness efficiency than the other two technologies.

This is the case with Planar® DriveSense™ architecture used in the Planar LED video walls including the Planar® DirectLightX LED Video Wall System, Planar® TWA Series and Planar® TWS Series.

*Power consumption per square meter comparison for 400cd/m² brightness setting for two different control room contents: CCTV and SCADA.*




*33% power consumption reduction compared to Rear Projection*



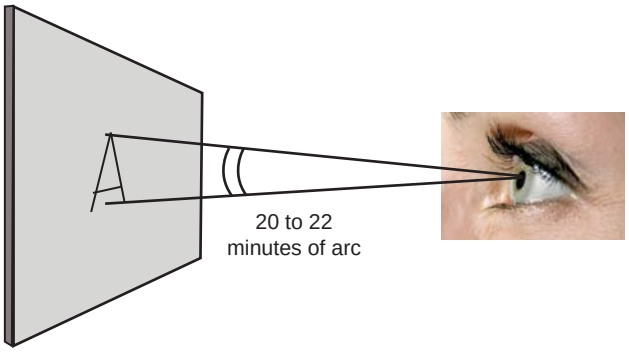
## Pixel Density

Another prejudice against direct view LED video walls in control rooms has long been the relatively low pixel density when compared to other display technologies. This is however based on a general misconception of ergonomic rules — the video wall definition has to be defined according to the operator's perspective and what a normal human eye can discern from its viewing distance, which is superior to 1 minute of arc. As a consequence, any information detail below this threshold is not perceivable and wasted.

One minute of arc corresponds of a 1mm pixel viewed from a distance of 3.4 meters / 11feet ( = 0,001/tan(1') ), which is a standard control room viewing distance. An LED video wall is characterized by its pixel pitch, which is the distance in millimeters from the center of a pixel to the center of the adjacent pixel in millimeter.

Current LED video walls in control room have pixel pitches from P1.2, to P1.5, to P1.8, which are empirical optimal values generally admitted for small size, to middle size, to big size control rooms.

For very small control rooms, with operators very close to the video walls, the pixel pitch required (P0.7 to P0.9) may be out of budget, and the other technologies more practical.




*Empirical studies have shown that for legibility, the height of a lower case character must underlie at least 10 minutes of arc. As the eye moves off-axis, this figure needs to be increased. In fact, the ANSI standards call for a minimum of 16 minutes of arc, and recommends 20 to 22 minutes of arc. This corresponds to 22mm viewed from a 3.4m/11ft distance.*

| PERFORMANCE COMPARISON | | |
|---|---|---|
| | **Direct View LED** | **Planar Direct View LED Video Wall Solutions: *Planar DriveSense (DirectLight X, TWS, TWA)*** |
| **High Reliability and Redundancy** | **Bad**: LED video walls are often designed for retail applications with no redundancy features | **Good:** Redundant power supply with two parallel video channels for Planar TWA Series and Planar® TWS Series; Hot-swappable power modules for Planar® DirectLight X |
| **Extended Lifetime** | **Good:** LED video walls usually stable in time | **Better:** By reducing the power consumption, Planar DriveSense also reduces the heat dissipation and the video wall lasts longer |
| **Image Uniformity and Bezel** | **Best:** No bezel and perfect uniformity | **Best:** No bezel and perfect uniformity |
| **Picture Quality and Precision** | **Good:** As long as the pitch is adapted to the viewing distance | **Good:** Selection of pixel pitch from 0.7mm to 2.5mm |
| **Resistence to Image Retention** | **Medium**: Difference of calibration (reversible) of the pixels will appear over time with static content | **Better:** By reducing the power consumption, Planar DriveSense also reduces the risk of un-calibration |
| **Power and Heat** | **Medium:** Standard common anode products will typically require more power for a given brightness | **Good:** Planar DriveSense products require less power and dissipate less heat than average rear projection systems and LCD video walls |
| **Small Footprint** | **Good**: Front service models available. Rear service designs also require less space than rear-projection | **Good:** Available in both front service (Planar DLX) and rear service (Planar TWS Series and Planar TWA Series) with minimum footprint |

# Control Room Verticals

The specific control room requirements and subsequently most adapted display technology may vary greatly according to the applications and the control room size. This chapter aims at reviewing each of the control room sub-markets and provides technological feedback.

## Network Operation Centers

*Operator's distance makes rear projection or LCD more appropriated*


***Iusacell** — Mexico City, Mexico*
*Clarity Rear Projection Video Wall (70" Full HD)*

The telecommunication market demands fast deployment of maximum quality and high-value services. An increasing number of equipment and complex operational procedures need to be analyzed and monitored in real-time.

The continuous display of timely data is focused on tracking the availability of the network as well as its structural integrity.

These control operations take place in Network Operation Centers (NOC) designed to improve the efficiency of network management.

### NEEDS

- High density of web-based content, (prediction) graphs, static content. The video wall also has a marketing value for the company.

### TECHNOLOGY

- Rear Projection, LCD and LED are all suitable, depending on the size of the project and the operators distance to the video wall, although more and more installation are completed with tiled LCD.

# Traffic Management

*A typical combination of two display technologies — rear projection for multi-purpose display and LCD for CCTV cameras*


***VINCI Control Center —*** *Tarare, Rhone-Alpes, France*
*Rear Projection Video Wall (3x2 of 60") and Two LCD Video Walls (2x2 of 55")*

*Train traffic control center displaying SCADA, with a few video overlays*


***ADIF Zaragoza***
*Rear Projection Video Wall (14x3 of 67")*

The increasing levels of congestion, declining mobility and rising environmental concerns demand improvement throughout transportation systems. Data coming from instruments such as video surveillance systems, variable message signs or detectors must be routed and displayed in real-time.

These control processes executed in Traffic Management Centers are directed at improving mobility, enhancing safety and increasing the productivity of existing transportation systems.

## NEEDS

- Large amount of IP (camera) sources in high resolution and a central map for road infrastructure management. Train, subway and trams applications will have a very prominent SCADA applications to monitor traffic and energy.

## TECHNOLOGY

- All three technologies can be applied with success here, depending on the size and importance of the central map, the number and resolution of the CCTVs.

# Surveillance


***EuroTunnel*** *— Coquelles, France*
*Planar TWA Series LED Video Wall (7x3 of 1.8mm)*

***Memphis Police Real Time Crime Center*** *— Memphis, Tennessee, USA*
*Clarity Matrix LCD Video Wall System (13x2 of 55")*

Surveillance control rooms are places where the ability to make the right decision at the right time is critical. More large cities and organizations are equipping themselves with image acquisition and processing technologies.

At the end of this system is the display, installed where decisions are taken to react to matters uncovered by cameras, sensors, computers and alarms. The quality of the display will have a major influence on the capacity of the operator to make decisions.

### NEEDS

- Different sources (cameras, maps, applications, etc.), combination of a central video wall & side displays, budget constraints, smaller solutions with space constraints.

### TECHNOLOGY

- LCD will definitely match perfectly small surveillance rooms, while LED offers additional flexibility for larger centers, especially requiring more display flexibility and truly seamless display surface.

# Utilities and Process Control

*Rear projection application with typical black background SCADA*


***ELES** — Ljubljana, Slovenia*

*Rear Projection Video Wall (3x2 of 70")*

*Rear projection application with light grey background SCADA*

***Water Purification — Karlsruhe, Germany***

*Rear Projection Video Wall (9x2 of 60" Full-HD)*

Power generation facilities as well as distribution and transmission units are all challenged to meet the increasing energy demands. Ongoing environmental concerns and competitive pressure demand the need for more efficient control procedures.

SCADA systems are used in combination with display walls to optimize supervision and management.

Process operators are provided with visual information to monitor the status of the plant, diagnose issues and rapidly make decisions that can prevent incidents and facilitate accurate production and distribution operations.

### NEEDS

- Typical lower resolution SCADA application, 24x7 with static content, redundancy, over a 10 year lifetime; A few CCTV cameras.

### TECHNOLOGY

- Rear projection has long been the major display technology in this segment for not being subject to image retention. Direct view LED for its perfectly seamless canvas is a serious new contender in an application that doesn't require very high definition.

# Broadcast Control Rooms


***RAI-WAY** — Rome, Italy*
*eyevis Rear Projection Video Wall (3x3 of 60")*

The increasing complexity of modern broadcasting equipment drives the requirement for display and control of information to respond effectively to various situations. Control procedures of the various video feeds are executed in Master Control Centers, for example in satellite broadcasting centers, monitoring the broadcasting of hundreds of channels.

The goal is to effectively manage in real-time the continuous information flow, essential for the director's team to anticipate all critical situations.

### NEEDS

- High resolution, high density of sources, layout permits seams

### TECHNOLOGY

- Tiled LCD, 4K LCDs, as the display optical characteristics are the closer to consumer TVs. Rear projection is also widely used.

# Command and Control

***Cyviz Technology Center*** *— Washington DC*
*Clarity Matrix LCD Video Wall System (3x2 of 55")*

The complexity of modern defense environments drives the requirements for rapid situation awareness—key for fast and accurate response.

The control procedures of real-time multimedia data are executed in Command Centers.

Displayed elements such as video sources, mission-driven databases, or detailed Digital Terrain Elevation Data need to be visualized quickly and without errors by decision makers.

Often these control rooms are mobile shelters and require quick and easy deployment.

### NEEDS

- Limited amount of sources, mainly maps and video, sources across large surface – easy to deploy, limited real-estate (shelters)

### TECHNOLOGY

- LED or LCD

# Situation Rooms


***Ministry of Interior Stuttgart Crisis Room*** *— Stuttgart, Baden-Württemberg, Germany*
*eyevis LCD Video Wall (3x4 of 55")*

A Situation Room is usually a back-up room to a main control room, designed to manage crisis situations. Stressful emergency situations require information sharing be quick in order to support decisive action.

In this situation the video wall becomes the focal point from which operators share information. Crisis operations will preferably be managed through pre-defined display layouts.

### NEEDS

- Space constrained environment, limited amount of sources, non 24x7 operation, local connections & breakout

### TECHNOLOGY

- LCD video walls provide all the required characteristics and the most affordable price.


# Conclusion

The selection of Control Room display technology is a complex process that involves many aspects: ergonomics, operator's comfort, content, budget, space constraints, video wall usage, product technicalities, redundancy and ruggedness. In an industry where technologies are evolving very rapidly, expertise matters.

On the strength of its extensive experience, Planar and eyevis have gained impressive expertise in engineering control room solutions in a wide range of applications from telecommunications to power generation, broadcast to traffic, to security control rooms.

As a global leader in display technology, Planar provides control rooms with all three display technologies in substantial volumes, allowing the company to provide technical expertise with no bias towards one technology or the other.

Planar and eyevis can therefore offer consultancy, as well as access to showrooms and customer reference sites across the globe to demonstrate the true performance of display technology in real situations, with the specific content of each project.