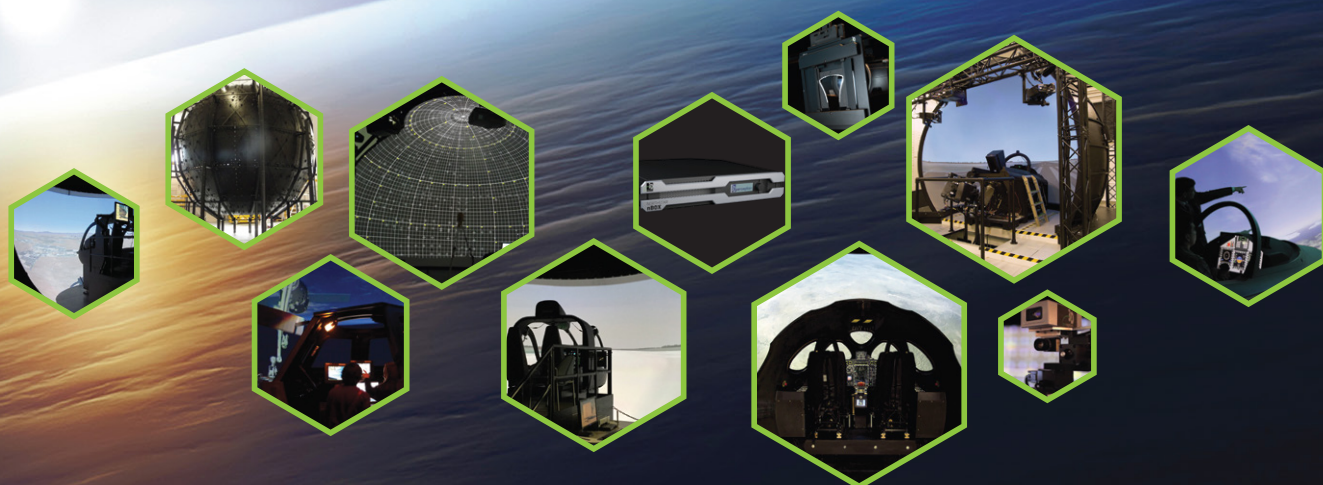# 3D
perception

SIMULATION DISPLAYS
SEAMLESS | FOCUSED | PERFORMANCE

About 3D perception

3D perception designs and supplies seamless, immersive visual display systems and technologies for simulation applications.

Serving worldwide defense and aerospace customers since 1997 with an international force of engineers, installers, project managers, and support staff, 3D perception ensures seamless, focused performance.

Gripen Flight Training Device photo courtesy of Saab

Innovation & Experience Powered by People

3D perception's people make the difference. We employ industry professionals in visual system engineering, program management, field service installation, customer support, account management, and product development.

Our staff's combined experience, vision, and passion result in innovative and exemplary products and services.

Customers choose 3D perception because we have a track record of excellence in providing the entire solution; before, during, and after delivery. We enable simulation companies to focus on what they do best, and to not be concerned with developing custom visual display systems for every new project.

3D perception Provides

▸ Innovative product development
▸ Projector and Image Generator independent solutions
▸ Industry-proven expertise in engineering and integration
▸ Precision automatic image alignment
▸ COTS and custom systems and upgrades for land, sea, air, and space simulators
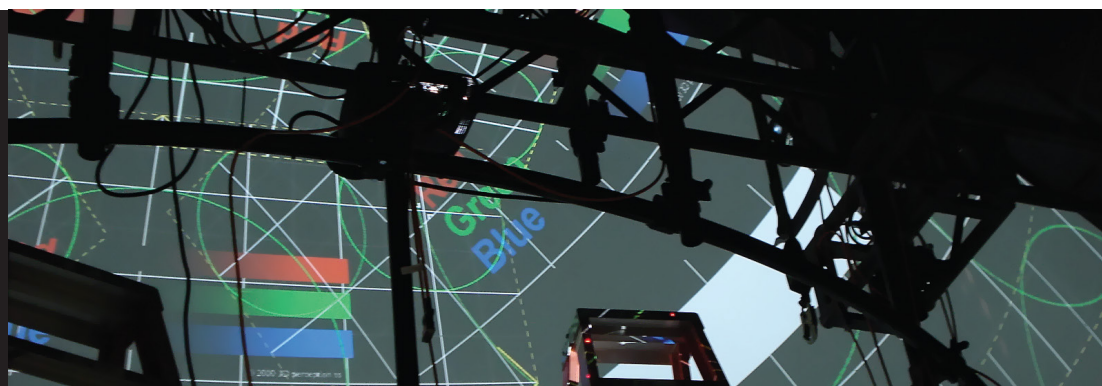
Engineering & Integration

3D perception provides display solution design and integration services at any point in the procurement process and is well positioned to contribute innovative concepts and proven methods to any project.

There are many factors to be considered in configuring a theater to meet program specifications. 3D perception's engineers blend technical knowledge, field experience, and a proven design toolset to ensure performance.

Dependable Results with nDesigner™

3D perception's solution for developing visual display system designs to meet complex requirements is our nDesigner™ toolset.

This sophisticated internal modeling software allows 3D perception to design, analyze, and previsualize any type of projection display system, while adhering to performance requirements, and incorporating room layout, cockpits, and other obstructions.

nDesigner accounts for a multitude of variables such as projector model, lens selection and settings, eyepoints, and screen size, shape, and surface gain. The tool provides detailed plots for luminance, resolution, observability range, and outputs Aitoff coverage diagrams showing channel locations, cabin windows, shadows, and other obstructions, and can predict performance from any eyepoint.
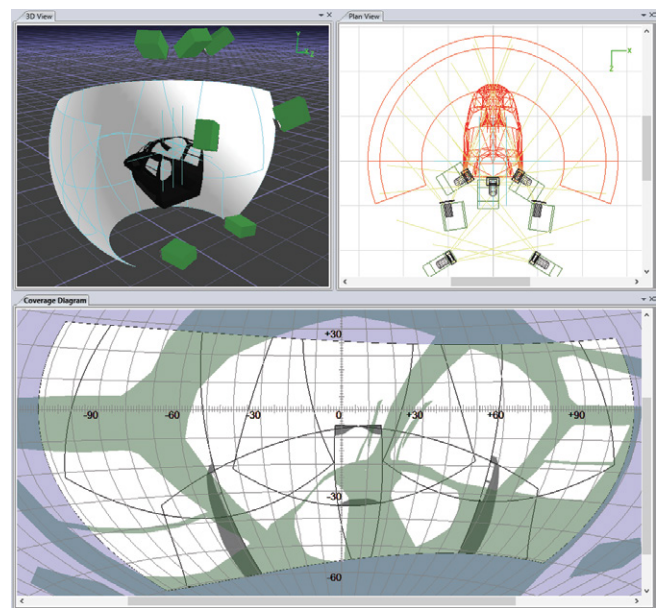
Developed and consistently updated to meet the changing needs of the market and our customer base, this tool is well-proven to facilitate the implementation of valid, optimal designs from concept through to completion.
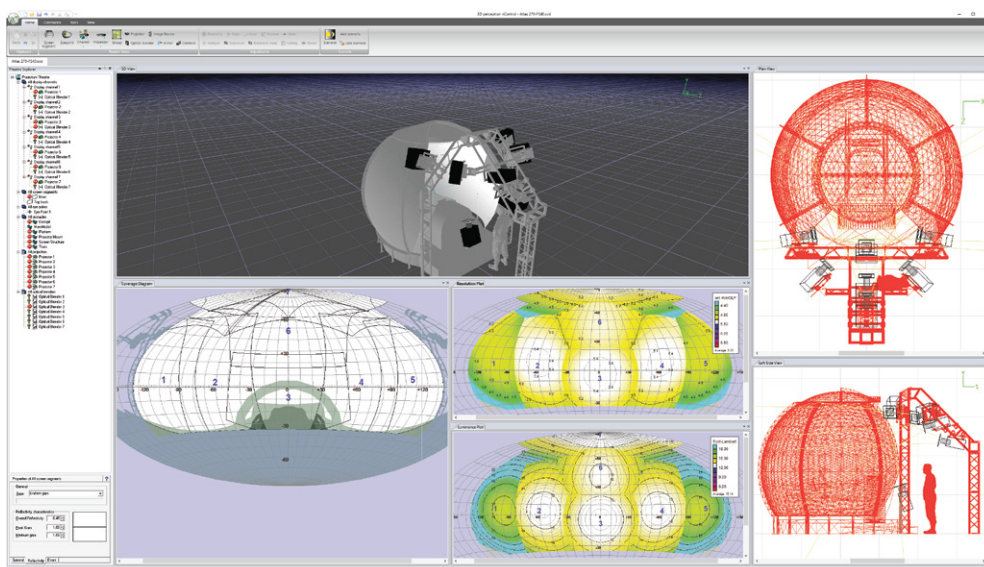
Features

▸ Detailed performance modeling
▸ Screen analysis
▸ Projection analysis
▸ Shadow analysis
▸ Plots and diagrams provided in proposals

NORTHSTAR™
SIMULATION DISPLAY SOLUTION

Northstar™ is 3D perception's integrated simulation display solution, providing industry-leading display processing and management, projection and image optimization, and precision automatic image alignment and calibration, all under a centralized system interface.
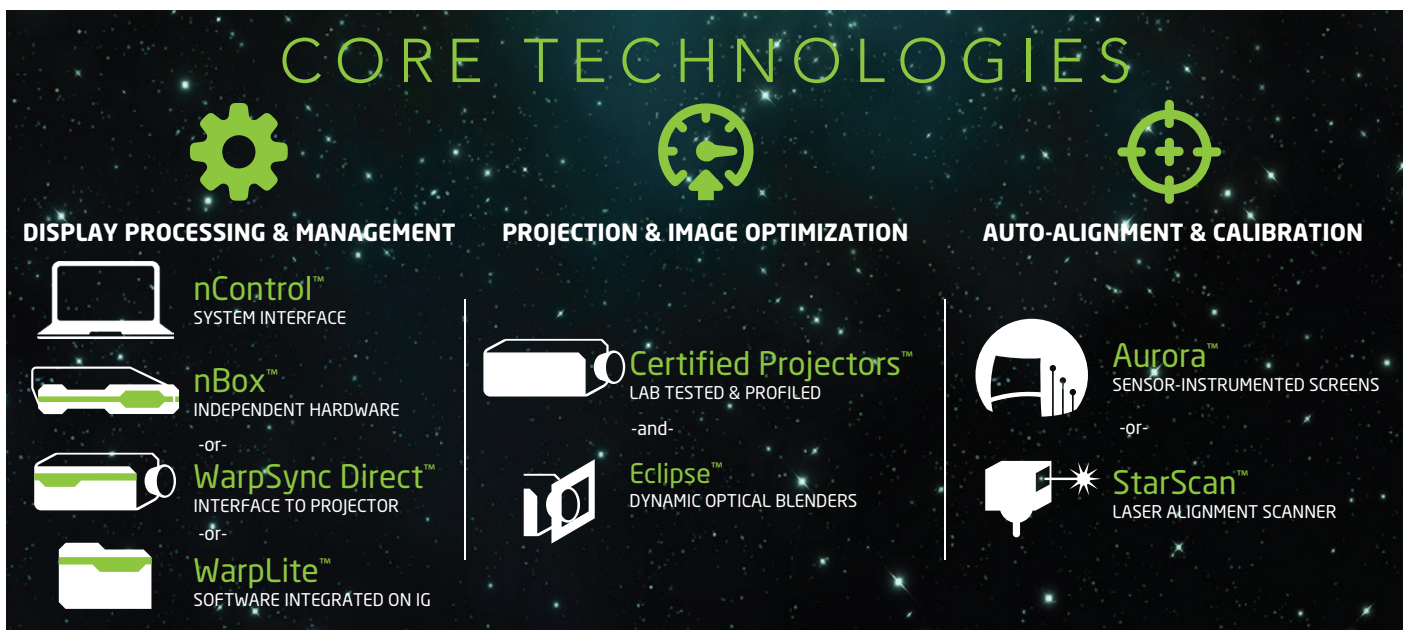
Display Processing & Management
Northstar offers several options for display processing: A hardware-based projector and content independent architecture is offered via nBox™, WarpSync Direct™ takes advantage of the warp and blend processing power built into some projectors, and WarpLite™ integrated on the user's IG offers a software-based path. All options are managed by the system unifying interface nControl™ software.

Projection & Image Optimization
The combination of Northstar Certified Projectors™ with Eclipse™ dynamic optical blenders results in a seamless image at all times of day, while maintaining full image contrast and dynamic range.

Auto-Alignment & Calibration
Fast, precise, and easily repeatable automatic image adjustment is provided via sensor-instrumented Aurora™ screens. StarScan™ provides for an alternative path for dome display upgrades, rear projection, and collimated displays.

CORE TECHNOLOGIES

DISPLAY PROCESSING & MANAGEMENT

nControl™
SYSTEM INTERFACE

nBox™
INDEPENDENT HARDWARE

-or-

WarpSync Direct™
INTERFACE TO PROJECTOR

-or-

WarpLite™
SOFTWARE INTEGRATED ON IG

PROJECTION & IMAGE OPTIMIZATION

Certified Projectors™
LAB TESTED & PROFILED

-and-

Eclipse™
DYNAMIC OPTICAL BLENDERS

AUTO-ALIGNMENT & CALIBRATION

Aurora™
SENSOR-INSTRUMENTED SCREENS

-or-

StarScan™
LASER ALIGNMENT SCANNER

Features

▸ Centralized system control via unified interface
▸ Precision auto warp and blend in seconds
▸ Push-button color and luminance calibration

▸ Options for IG and projector independence
▸ Options for IG of projector-based warp and blend
▸ Future-proofed upgrade path

nControl™
Northstar System Interface

nControl™ is an intuitive, user-friendly, graphical interface for control and maintenance of Northstar displays and enables users to approach their display as an integrated system as opposed to separate components.

nControl is responsible for maintaining a consistently optimized image in concert with all Northstar components, managing geometry adjustment, edge blending, color balancing, and gamma correction. With the push of a button, it automates maintenance procedures and readjusts the image in seconds.

Following automatic correction, additional fine adjustment can be made to a graphical warp grid, in real-time. nControl provides the ability to automatically apply additional adjustment layers to subsequent auto-alignments and in addition, can compensate for screen imperfections.

nControl is installed on the user's maintenance computer or simulator host which is networked to the rest of the system.

Features

▸ One-click power up/down and maintenance
▸ Save/load multiple training profiles; change eyepoints, account for different obstructions
▸ Control Eclipse™ dynamic optical blenders for time-of-day optimization and NVG training
▸ Automates procedures which otherwise take hours
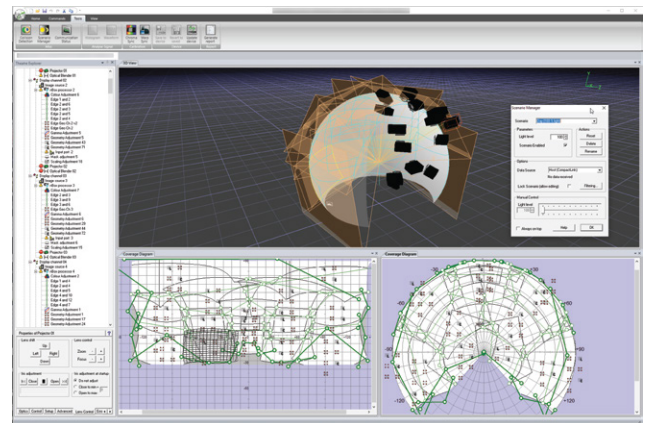
nBox™
Multichannel Display Processor & Manager

nBox™ is an all-in-one display processor that provides an independent system architecture, requiring no software integration with or processing power from the IG and ensures compatibility with the ever-evolving pace of projection technologies.

A stackable 2U rackmount industrial embedded device, the next-generation display processor warps, blends, calibrates color and gamma, and compensates for hot spots across multiple projectors on any screen shape, creating an absolutely seamless and uniform image.

Features

▸ Up to 6 channels per unit
▸ Stackable for any number of display channels
▸ Powered by 3DP's patented Digital Geometry Processor
▸ Intelligent EDID
▸ Resolutions up to 8K
▸ Full projector control
▸ Sub-frame latency (1-4 ms typical)

▸ Hot-swappable power supplies & I/O boards
▸ Scenario management
▸ Non-linear image warping
▸ Auto image alignment
▸ Auto color calibration
▸ Gamma correction
▸ Hotspot compensation
▸ Black level compensation
▸ Input signal analysis
▸ DisplayPort & DVI interfaces

DISPLAYPORT	4096 x 2400	7680 x 4320	REFRESH RATE	NORTHSTAR
	4K	8K	UP TO 240 Hz	3D perception

WarpSync Direct™
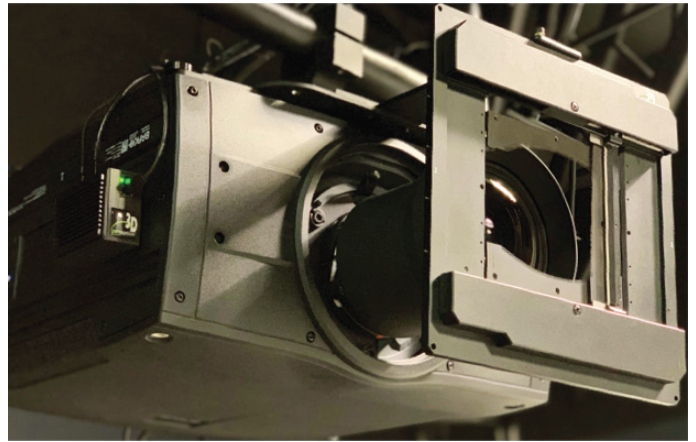## Automatic Warp & Blend Projector Interface

3D perception's Northstar simulation display solution can take advantage of the built-in warp and blend functionality within certain supported projector models.

WarpSync Direct™ empowers all of Northstar's features for automatic image alignment, color and brightness calibration, fine-tuning, scenario management, and test pattern generation without the need for separate image processing hardware or IG-resident warp and blend software.

To enable on-demand image auto-alignment, SyncNode™ units are triggered from nControl to project alignment patterns. These patterns are detected by WarpSync™ sensors or StarScan™ and in seconds, a completely seamless display is produced.

SyncNode is powered over LAN and connects to the HDMI port of the projector and switched to that source when producing patterns.

Color and luminance parameters can be changed manually or automatically when ChromaSync Direct™ is supported by the projector selection.

Features

▸ Works with projector-based warp and blend
▸ Image Generator independent

▸ Fully integrated under Northstar solution
▸ Fast and precise auto-alignment

WarpLite™
## Image Generator-Based Software Warp & Blend

3D perception's WarpLite™ is a cost-effective warp and blend image processing software package, offering a unique set of features never before available.

Designed for flexibility, ease of use, and reliability, this real-time software is capable of processing any resolutions supported by the customer's Image Generator.

Like all Northstar products, WarpLite is managed by nControl, enabling the user to create and maintain a seamless and high-quality image across a curved or flat projected display.

Features

▸ Installed on user-supplied Image Generator
▸ Powered by nControl through LAN
▸ Fully integrated under Northstar solution
▸ Supports Windows and Linux
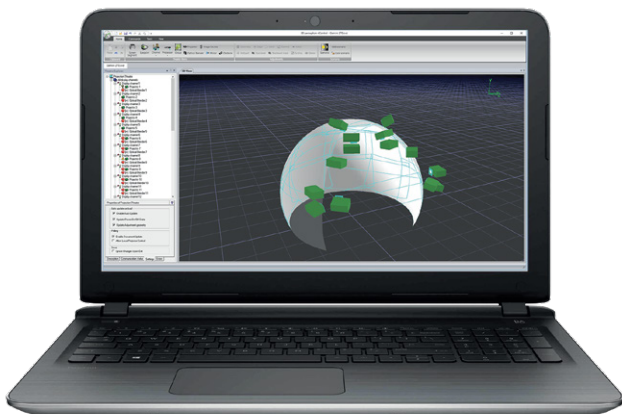
Aurora™

Auto-Aligning Sensor-Instrumented Screens

3D perception's Aurora™ instrumented screens are key to performing automatic image alignment and edge blending in the Northstar display eco-system. The enabling technology in the Aurora screen concept is 3D perception's WarpSync™ sensor technology.

During the on-demand auto-alignment sequences, projected alignment patterns are measured by the invisible sensors. The data captured is used by the nControl software to apply geometry correction, edge blending, and lens distortion correction on each channel in the multi-image projection theatre to result in a perfectly and seamlessly aligned, warped, and blended image.

Since WarpSync sensors are embedded, they will remain static and out of the way—as compared to camera-based systems that require multiple cameras to be precisely mounted and maintained at deterministic locations. The cameras themselves will sometimes require re-alignment; a service which, in many cases can only be provided by the supplier. With Aurora, the screen is the data capture device, and requires no maintenance.
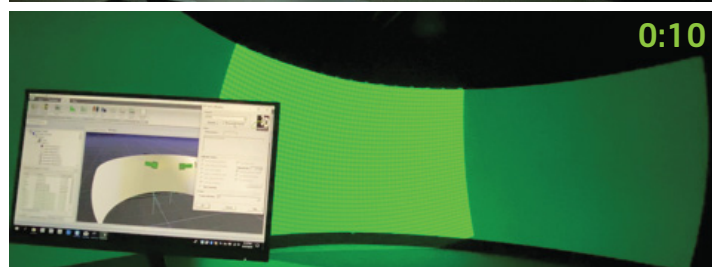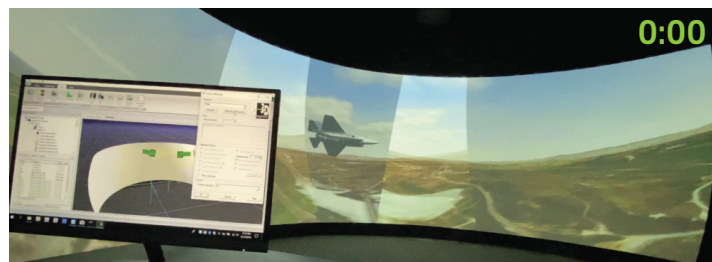
Features

‣ Enables Northstar's automatic warping and blending, 5-10 seconds per projector
‣ No separate instruments to maintain
‣ Many available dome radiuses ranging from 1.0 to 4.0 meters, tailored to any field of view
‣ Custom design and fabrication available for any size and shape requirement

WarpSync sensors embedded within screen detect alignment patterns for precision automatic warping and blending. Sensor heads are finished on plane with the screen surface and become completely invisible.

StarScan™
Automatic Image Alignment Scanner

For Northstar systems where Aurora's screen-based sensors are impractical, including soft-screens, rear-projection, collimated screens, or for system upgrades, StarScan™ is the ideal solution for precision automatic image alignment.

A true 3D solution for a 3D problem, StarScan provides detailed measurements of display system geometry using high precision gimbal pointing, and laser rangefinding. StarScan measures both the exact 3D screen geometry and the projected image geometry, resulting in the industry's most accurate warp and blend - down to 1 arc minute.

The device can be mounted virtually anywhere in the display system and can automatically align itself using reference points on the screen, enabling repeatable, high accuracy performance, even from off-center locations.

Using precision gimbal pointing, StarScan operates up to a 360° azimuth and 135° elevation range, with options for eye-limiting resolution accuracy.

StarScan requires no special software to be loaded onto the user's IG, nor does it require the 1.5-2 ms of IG render time required by software and camera-based solutions.



3D Screen Mapping & Alignment

StarScan creates a detailed 3D screen surface map using the gimbal-mounted laser rangefinder. This map is used in geometric projection software to calculate the location for every alignment point on the real display surface. This surface map can also be used for display system acceptance testing to ensure compliance with design specifications.

Screen Integration Support

The integrated rangefinder can be used to accurately locate a screen to specified coordinates to ensure proper setup.

Features

▶ Precision 3D screen mapping and image auto-alignment
▶ Up to 360° H x 135° V operation area
▶ Absolute geometric accuracy 1 – 5 arc min
▶ Off axis alignment head positioning
▶ Screen installation support
▶ Display channel setup support
▶ Easy and cost-effective retrofit of auto-alignment to existing installations
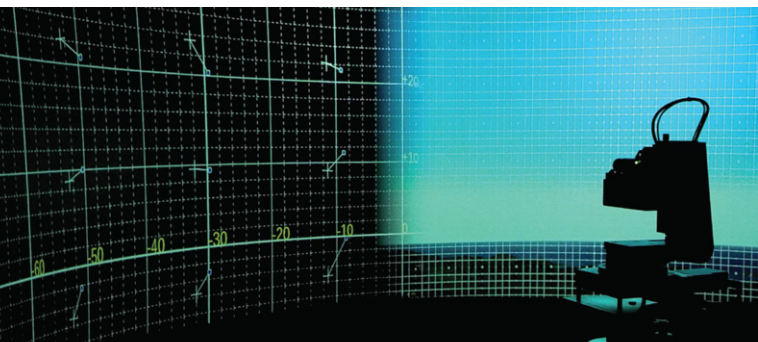
Northstar Simulation
Certified Projectors™

3D perception offers projector-independent solutions. This allows our customers to retain the benefits of a rapidly advancing feature set available in the professional projector marketplace. Not every commercially available projector should be used in a real-time, long service life, demanding environment. This is why we have developed the Northstar Simulation Certified Projector program—to indicate to our customers the specific projectors that pass our qualification of fit for use in professional simulation environments and are fully interoperable and seamlessly managed within 3D perception's Northstar solution.

Simulator systems have an array of differing projection requirements. Considerations like resolution, light output, lensing, NVG suitability, latency, contrast, weight, size, ruggedness, and cost are all important factors. It's key to have a range of models from which to select that can meet specific use-cases.

3D perception provides, integrates, and services a range of professional projectors from several manufacturers, and we are regularly adding to the catalog.

We offer options for DLP and LCoS technologies, HLD/LED, laser hybrid, and pure laser illumination, along with a wide range of high quality lenses, modules, mounts, and accessories. We design systems based on application requirements—not around a specific projector make or model.
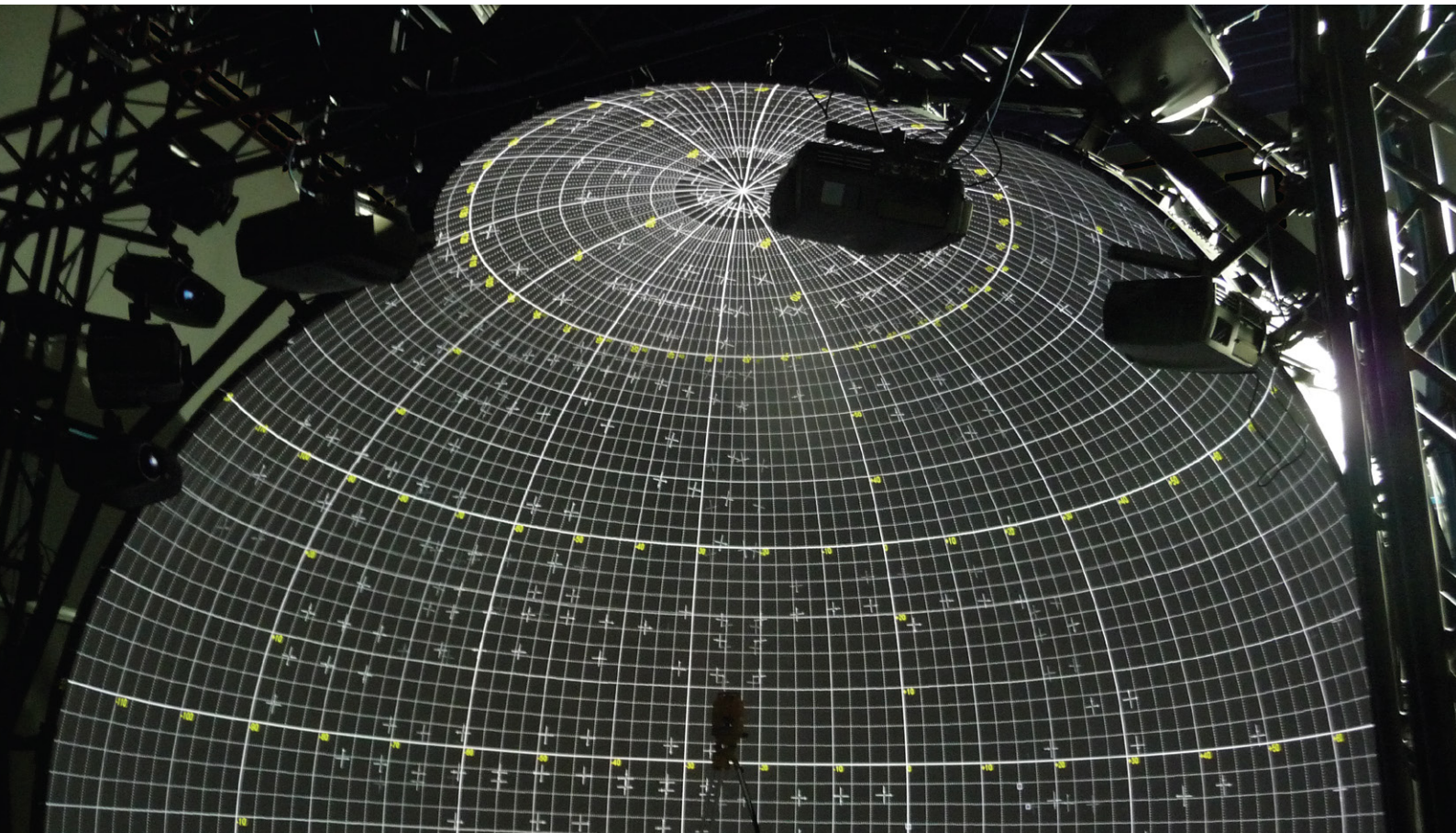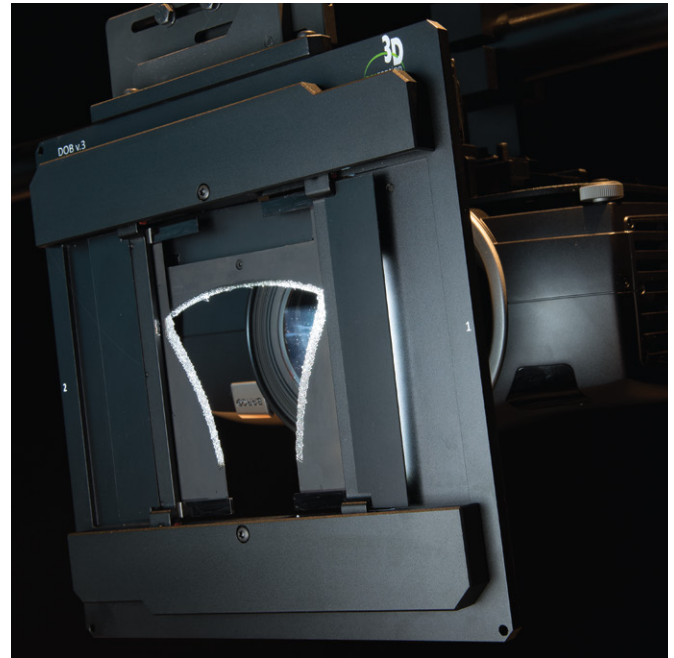
Eclipse™

Dynamic Optical Blenders

In a multi-projection display system, all projected images will have one or more sides overlapping with another image. In these overlap zones, the image will be doubly bright. During daytime scenarios, 3D perception's Northstar system automatically applies electronic edge blending to achieve a seamless, uniform image. During darker scenarios, the overlap zones cannot be completely electronically removed because all digital projectors output some level of light even with completely black content. The result is a bright stripe in the overlap. The only way to remove this without impact to contrast or dynamic range is with optical blending.

The Solution

3D perception's Eclipse™ dynamic optical blenders remove the visible edges and render the image seamless across the entire display. The blenders optimize the image without sacrificing contrast in favor of black level uniformity.

During transition periods like dusk or dawn, content becomes more difficult to optimize while completely eliminating the overlap zones. This unique challenge is addressed via hybrid blending—a combination of transitional optical blending AND electronic blending.
The servo-controlled optical blenders and electronic blends are gradually applied during transitional periods.

Eclipse blenders automatically make adjustments to the scene upon receiving time-of-day signals from the simulator. The Northstar system allows for smooth interpolation between scenarios, enabling a seamless and dynamic transition from day to night without interruption.

Features

▸ Eliminates extraneous light in overlap areas
▸ Optimizes image for day, dawn, dusk, and night without sacrificing contrast or dynamic range
▸ Gradual transitions, or immediate change on new scenario load
▸ Available with hard-edged or progressive blend blades with precision-cut gradient edges for the most demanding requirements
▸ Content-Awareness feature provides real-time signal analysis and blender adjustment

Turn-Key Systems
Commercial-Off-The-Shelf Northstar Displays

3D perception offers a wide range of preconfigured Northstar display systems designed and priced for quantity delivery. These domain-optimized systems are adaptable to accommodate trainer cabins or other components. Design variants are available for differing program requirements. Contact 3D perception for an up-to-date catalog of available systems.

Atlas™ Fixed-Wing Large Domes   **Draco™** Fast Jet Mini Domes   **Lyra™** Helicopter
Phoenix™ Spacecraft   **Cetus™** Maritime   **Gemini™** Air Support   **Orion™** Multipurpose

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