



Holographic Display for The 3D Battlespace

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Executive Summary

Avalon's NOVAC is a cutting-edge holographic display system poised to redefine defense and security visualization. Tailored to address the evolving challenges of modern defense landscapes, NOVAC enhances situational awareness and facilitates collaborative planning by providing a true 3D visualization experience. Designed for seamless interoperability with established systems like TAK and SIMDIS, NOVAC integrates diverse battlespace data into a unified 3D display, enabling defense agencies to navigate complex scenarios with unprecedented precision and efficiency. With a 40" diagonal screen, 74-degree viewing angle, and over 5 billion rays, NOVAC offers an immersive visual interface that transcends traditional display capabilities, empowering users to make informed decisions and optimize resource allocation.

NOVAC's versatility extends beyond its technical specifications, offering tangible benefits across a spectrum of defense applications. Whether enhancing mission planning through dynamic 3D visualizations of flight paths and terrain features, optimizing radio planning by visualizing RF propagation in varying scenarios, or facilitating virtual training by enabling adaptive learning experiences, NOVAC serves as a pivotal asset in modern defense operations. Its ability to ingest and integrate real-time data—ranging from sensor inputs and topographical data to dynamic threat assessments—enables defense personnel to make informed decisions and adapt strategies in real-time, enhancing operational effectiveness across diverse defense sectors. Supported by robust endorsements from defense communities and successful engagements with major contractors, NOVAC stands as a testament to Avalon's dedication to advancing defense capabilities through cutting-edge technology.



Figure 1: NOVAC Holographic Display

Introduction

In an era where the dynamics of defense and security are constantly evolving, the integration of cutting-edge technologies becomes paramount to maintaining a strategic advantage. Introducing the next frontier in visual display technology: the true holographic display. Unlike traditional two-dimensional displays, this innovative holographic solution offers a three-dimensional, immersive visualization experience, enabling operators and commanders to interact with complex data and scenarios with unparalleled clarity and depth.

This holographic display, available today, addresses critical challenges faced by defense organizations, such as information overload, spatial limitations, and decision-making under pressure. By presenting data, terrain, and simulations in a holographic format, it enhances situational awareness, facilitates collaborative planning, and streamlines communication among military personnel. Furthermore, its ability to render dynamic, real-time visuals in a 3D space empowers defense agencies to simulate various scenarios, optimize resource allocation, and devise more effective strategies and responses. Embracing this holographic display technology not only revolutionizes the way defense operations are conducted but also reinforces the commitment to leveraging innovation for safeguarding national security interests.



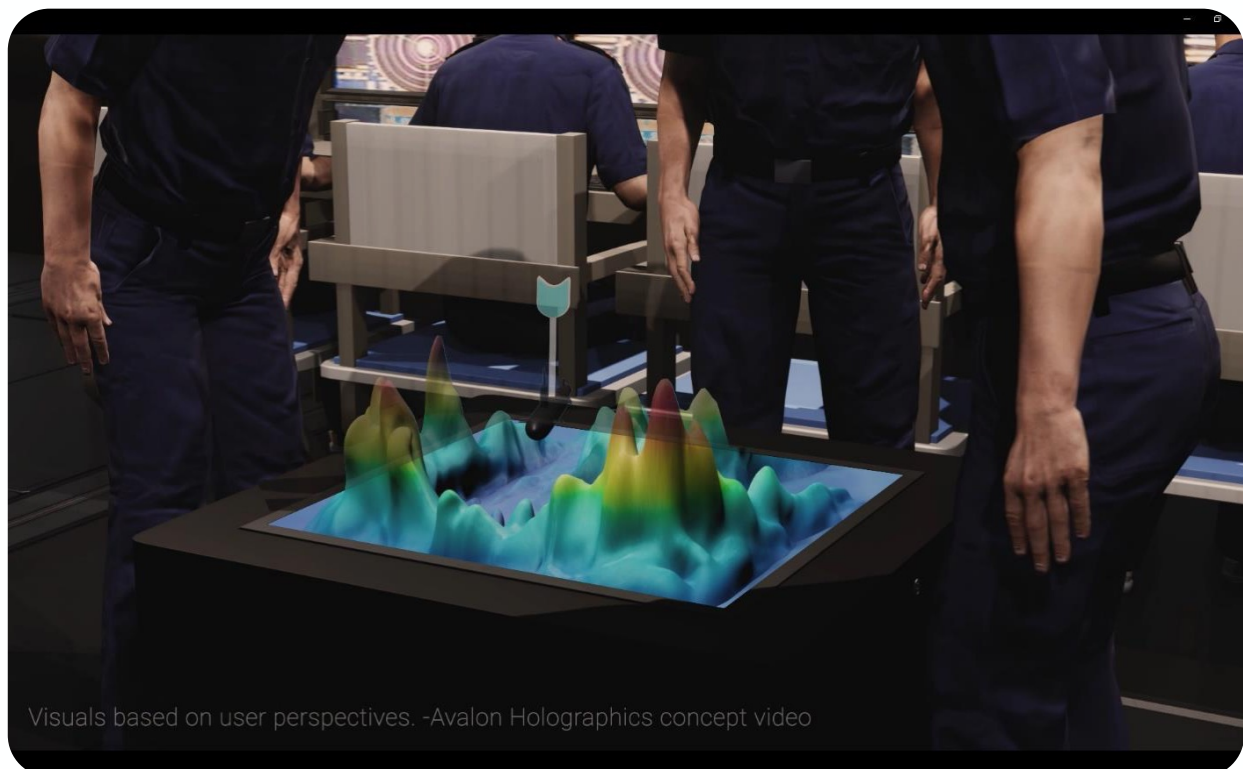
Holographic Display Technical Specifications and Capabilities

NOVAC solves these long-standing data visualization problems with powerfully detailed holograms that provide a natural 3D Common Operating Picture and Battlespace Situational Awareness. Designed to be interoperable with existing systems like TAK and SIMDIS, NOVAC delivers a 3D view without the need for any headsets or awkward accessories. By reducing cognitive load and improving operational tempo, NOVAC empowers users to make better decisions, faster.

NOVAC stands as a pioneering platform that adeptly ingests critical battlespace data, encompassing intricate details like terrain and bathymetry, through universally recognized OGC formats such as 3D Tiles, as well as ingesting common data sources like Google Maps and Esri. Future data sources like One World Terrain (OWT) can be easily integrated.

Going beyond mere topography, NOVAC seamlessly integrates platform and entity information into the dynamic 3D environment either via predefined scenarios or a robust API framework. Furthermore, the platform can ingest a diverse array of inherently 3D sensor data types – including but not limited to SONAR, radar, and RF – into the unified 3D scene. The culmination of these capabilities manifests in a truly immersive holographic viewing experience, enabling stakeholders to engage with complex data sets in a natural, intuitive manner, thereby fostering enhanced situational awareness and informed decision-making within defense and strategic sectors.

NOVAC is 40" diagonal screen, has almost a foot of depth, more than 5 billion rays, and can be seen by multiple viewers.



Visuals based on user perspectives. -Avalon Holographics concept video

Technical Requirements

Display	
Screen Size	40"
Resolution	63,888 x69,696 5 Billion Rays of Light. Equivalent to 2,500 HD TVs
Active Pixels	4.5 Billion
Aspect Ratio	1:1 (Square)
Light Field	
Number of Viewers	6-8
Viewing Angle	74 degrees x 74 degree viewing angle (other optical configurations available)
Dimensions	
Size Dimensions (L x W x H)	3.5' L x 3.2' W x 2' H
Weight	929.5lbs, 422.5kg
Power Consumption	6700 watts
Software Details	
Battle Management System Integration	SIMDIS, TAK, AFSIM, Google Maps, One World Terrain, ESRI/ArcGIS, etc

Operational Problems

ISR for Advanced Situational Awareness in All Environments:

In dynamic C2/C4ISR environments where comprehensive fusion of battlefield information is paramount, the management of cognitive load becomes pivotal, given its direct impact on decision-making and situational awareness. The NOVAC holographic display elevates Advanced Situational Awareness across all environments by seamlessly integrating and correlating diverse data sources, including Government-owned data and Publicly/Commercially Available Information (PAI/CAI). This fusion is visually portrayed in near real-time, offering a shared intelligence/Common Operational Picture (COP) that is both accurate and actionable. By presenting this multifaceted data in an intuitive 3D format, the holographic display empowers Warfighters to intuitively navigate and interpret the COP, significantly enhancing opportunities for knowledge management and discovery during operations. This innovative approach not only reduces cognitive burden but also optimizes operational effectiveness by facilitating informed and efficient decision-making in complex, data-rich scenarios.

Soldier Systems for Virtual Training:

NOVAC enhances soldier systems for virtual training by enabling mission training, preparation, rehearsal, and battle planning in an immersive 3D environment. This technology potentially allows instructors to dynamically revise or update scenarios on the fly, accommodating evolving operator capabilities and facilitating adaptive learning experiences.

Mobility and Aviation Systems for Enhanced Situational Awareness Systems:

NOVAC installed on manned combatant craft significantly enhances situational awareness for warfighters by actively ingesting static and real-time sensor and topographical data across air, land, and sea domains. This interactive system seamlessly integrates operational and planning scenarios, providing comprehensive domain awareness of the surrounding area and reducing cognitive workload. By populating critical information directly onto the craft's display system, the holographic display empowers warfighters with timely, actionable insights to effectively identify and respond to potential threats in diverse operational environments.

Expected Use Cases

Mission Planning/COA Development

A holographic display enhances mission planning and Course of Action (COA) development by visualizing critical elements like line of sight, radio propagation, RF signature reduction, route planning, change detection, and terrain analysis in a unified 3D environment. This comprehensive spatial visualization enables defense personnel to assess optimal communication paths, identify strategic positions, minimize RF exposure, plan efficient routes, and understand terrain complexities such as intervisibility. By integrating these key factors into a single, intuitive interface, holographic displays facilitate informed decision-making, ensuring precise and effective mission execution in diverse operational landscapes.

Mission Briefing

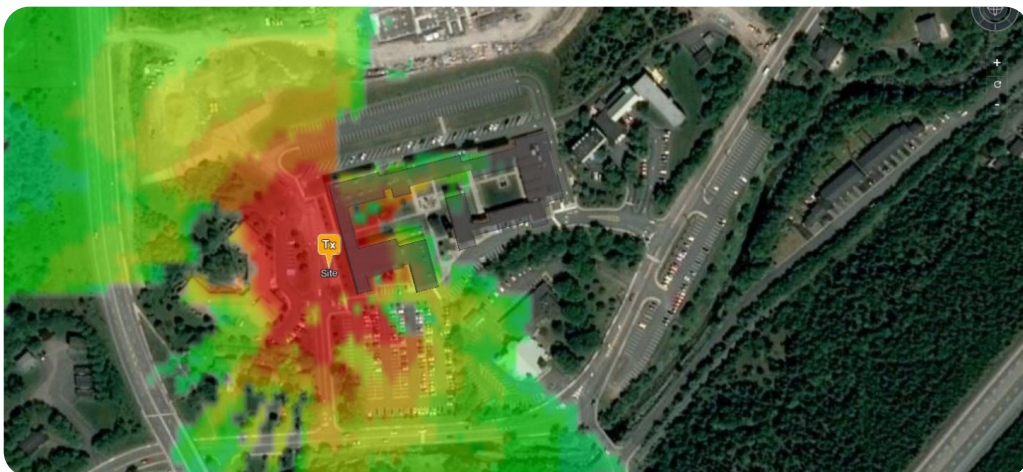
A holographic display enhances mission briefings by fostering real time situational awareness and facilitating multi-domain operations through collaborative visualization. By presenting a unified Common Operating Picture (COP), holographic displays promote a shared understanding among stakeholders, ensuring consistent and comprehensive information dissemination. This immersive visual context streamlines collaboration and enables faster, more informed decision-making processes, ultimately enhancing operational efficiency and mission success.

Jump Missions

A holographic display optimizes airborne mission planning by providing a dynamic 3D visualization of flight paths, offsets, terrain features, obstructions, and wind patterns. This immersive spatial awareness enables jumpmasters to select safe drop zones, adjust flight trajectories, navigate around obstacles, and account for wind conditions effectively. By integrating these critical variables into a cohesive visual interface, holographic displays empower jump teams to make informed decisions, ensuring accurate and secure parachute deployments in complex operational environments.

Radio Planning and Signature Mapping

A holographic display streamlines radio planning for tactical missions by visualizing RF propagation across varying scenarios, including weather conditions, interference levels, and transmitter/receiver configurations. This 3D visualization enables precise optimization of equipment heights, power settings, and frequencies, ensuring robust communication while minimizing RF signature to safeguard warfighters.



Traction/Testimonials

Avalon has been engaged with the defense community for over 7 of our 9 years. Battlespace visualization is the most consistently identified early application for holographic displays. We've closed greater than \$14M in contracts, primarily with major defense contractors and the Canadian government. Support from both Canada's Department of National Defence (DND) and the US Department of Defense (DoD) has been strong and steady. A select set of testimonials appears below (where appropriate, Chatham House Rules apply):

End Users:

"This would be especially useful tracking targets in difficult environments like urban settings. If I could deploy this tomorrow, I would."

– Active Operator (CANSOFCOM)

"We lost people in an operation, and during AAR we realized we missed key sightline info during mission planning. I think this technology could have made the difference in saving them."

– Active Operator (SOCOM)

"I feel like I'm looking at the very first steps of a technology that will one day be as commonplace as LCD monitors or seatbelts."

– Lead assessing advanced battlespace visualization and interaction technologies (Army Research Lab, DoD)

"We've tried every 3D technology out there, and they all disappoint. This is the real deal; I've been waiting my whole career for this."

– Ed Chaulk, Naval Combat Systems Officer, Maritime Warfare Center (Canadian Navy)

"Avalon will sell a lot of tabletop light field displays; even with a multi-million dollar price."

– Operator, Joint Innovation & Technology Battlespace (JITB) (Canadian Navy)

Prime Contractors:

"I was skeptical, but after seeing the demo, I've had our CTO add this to [our] Technology Roadmap."

"Avalon's holographic display technology will revolutionize how underwater data is visualized."

"Avalon represents a new generation of pioneers, opening frontiers for the future use of effective, yet unobtrusive methods of visualization."

Government Contracts

Avalon has been awarded several contracts under Canada's Innovation for Defence Excellence and Security (IDEaS) and Innovative Solutions Canada (ISC) programs. These are structurally similar to the US SBIR program, with similar goals. Specifically:

1. Holographic Battlespace Visualization: Modified SIMDIS – Littoral sight lines & RF coverage
 - Completed Phase 1a & 1b (equiv. to SBIR 1 & 2), discussing Phase 2 (SBIR 3)
2. 3D Visualization for Complex Info. Systems (w. MDA) – Completed Phase 1a
3. Holographic Space Situational Awareness: Conjunction Assessment & Collision Avoidance, Suspicious (RSO)
 - Completed Phase 1a
4. It's Not Just Noise: Acoustic Tools (w. Kongsberg Geospatial): Visualization of sonar data – Completed Phase 1a
5. Making Data Make Sense: RT Rapid Decision Making (w. 3D Planeta/Terris): Visualization and analysis of GIS data
 - Completed Phase 1a & 1b, discussing Phase 2
6. ISC-Testing Stream 1, 2 & 3: 1st Sales
 - Sold preNOVAC to DRDC Halifax; testing completed recently
 - Sold kidNOVAC to Navy Innovation (Canada)
 - Negotiating contract to sell HighGround software to Navy Innovation (Canada)

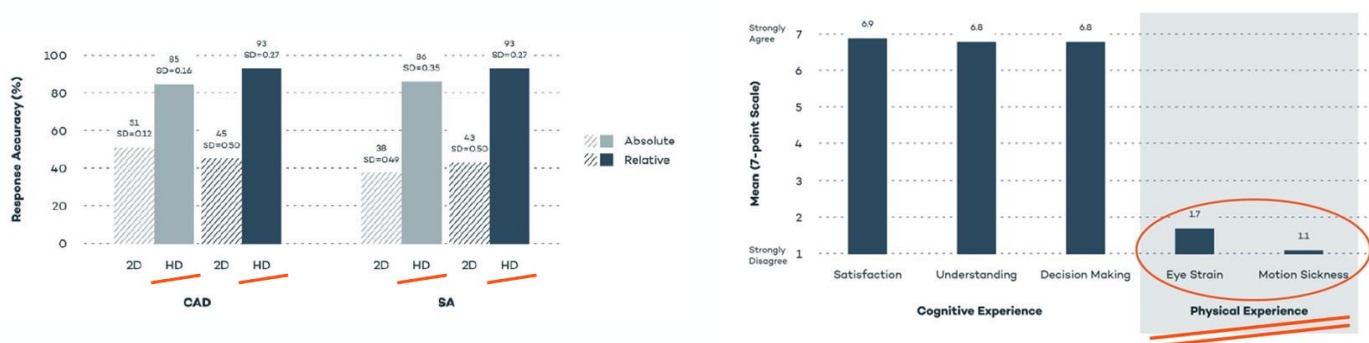


Holographic Benefits

Holographic prints are already used in several defense applications, and interest in displays has been prevalent for over 20 years. The constant drive for 3D graphics, taking off in the 1990s and evolving into today's virtual reality (VR) and augmented reality (AR) technologies, and the repeated issues and limitations encountered by these technologies, only reinforces this. The interest derives first from an intuitive sense that viewing information in natural 3D, the same way we observe the real world, must inherently be more efficient and effective. Human beings and our visual systems have evolved to react and respond to the natural light field very quickly, as a survival mechanism. Therefore, the best way to view this 3D information is as we view the real world when we need situational awareness in a three-dimensional context. The use of constructed physical models (including 3D printing), such as in the buildup to the Bin Laden raid, is a constant reminder of this desire. Space is always dealt with in a three-dimensional context.

Studies show that holographic visuals significantly reduce cognitive load by 20% to over 50%; this allows operators to make faster, more accurate decisions, and it enables faster learning and better training retention. Most studies were limited to printed laser holograms, but full motion digital holograms are expected to offer better results. Avalon has also conducted early prototype studies that show a significant cognitive advantage; decision-making accuracy improvements of 67%-126% and no viewer discomfort.

Qualitative Study Results (Avalon Holographics)



Rough Order of Magnitude (ROM) Cost Estimate

The ROM cost for the NOVAC system is five million dollars. While very expensive now, this technology represents a multi-generational leap in information consumption and can be an integral part of force protection. The long-term benefits in terms of enhanced situational awareness, improved decision-making, and operational effectiveness position make NOVAC a vital asset for defense organizations committed to safeguarding national security interests.