Whitepaper on available display technologies (in 2026) for effective Terrain Visualization and Sand Model Discussions

31st May 2026

This white paper has been prepared by M/s Pragyatec Research & Innovations Pvt. Ltd. to provide readers with a clear understanding of the immersive hardware technologies currently available in the market for supporting effective sand model discussions.

The document has been written with specific consideration of the Indian Army's requirements for terrain visualisation and sand model-based planning discussions. Based on extensive research, it presents a curated overview of immersive hardware devices that adopt distinct approaches to creating immersive sand model visualisation experiences. The intent of this white paper is to familiarise readers with the available technology options, their broad capabilities, and their relevance to collaborative terrain-based planning.

The scope of this research is focused on non-chinese companies and their offerings. Accordingly, Chinese companies and products have been kept outside the purview of this study.

All devices listed in this white paper can be integrated with Pragyatec's proprietary sand model discussion software, iNaksha. iNaksha is an advanced strategic and tactical planning tool that leverages emerging technologies to provide a dynamic platform for collaborative, interactive, and immersive discussions over operational plans.

More details can be found at www.pragyatec.com

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About Pragyatec:

Pragyatec (Pragyatec Research & Innovations Pvt. Ltd.) is a next-generation defense technology and deep-tech company specializing in immersive, intelligence-driven solutions. By fusing Extended Reality (XR)—including AR, VR, and Mixed Reality (MR)—with Artificial Intelligence (AI), Pragyatec builds mission-critical systems designed to enhance combat readiness, tactical planning, and operational execution for modern armed forces

Pragyatec is led by Wg Cdr Pankaj Gupta, an Air Force pilot with 21 years of flying experience and over 18 years of expertise in the defense simulation industry, and Mohit Ramani, a seasoned technologist with more than 16 years of experience and recognized among the early pioneers of immersive technology solutions in India across diverse industries.

Together, they bring a strong combination of operational defense insight, simulation domain expertise, and advanced technology leadership, enabling Pragyatec to design and deliver realistic, mission-focused, and future-ready training solutions.

Our Products

iNaksha	**iNaksha** is a holographic sand model platform for mission planning and battlefield visualization. Using AR and real-time terrain modeling, it enables teams to collaboratively plan, simulate, and adapt strategies across all warfare domains. Designed for joint-force coordination, it also supports future AI integration for scenario analysis.
Pankh-X	**Pankh-X** is a VR-based drone simulator that trains operators in piloting, surveillance, and tactical missions across realistic terrains. It offers a safe, immersive environment to build skills and improve decision-making for effective drone deployment in defense scenarios.
PITTRA	**PITTRA (Platform for Immersive Technical Training)** is an advanced MR/VR-based solution for hands-on technical training on complex defense equipment. It offers realistic, interactive modules with real-time feedback, enabling scalable, secure, multi-user learning via a robust client-server architecture.
VisTaS®	**VisTaS® (Visualization & Immersive Simulation of Tactical Scenarios)** is a GIS-based VR platform for terrain familiarization, operational planning, and tactical simulation. It uses geospatially accurate 3D environments to help troops rehearse missions, analyze routes, and enhance decision-making—improving readiness in a safe, immersive setting.
IMPACT	**IMPACT** (Immersive Mixed Reality Platform for Advanced Combat Training) delivers realistic weapon handling and tactical training by blending physical replicas with virtual scenarios. It sharpens marksmanship, decision-making, and situational awareness in a safe, immersive environment.

AIMS	**AIMS** (Advanced Integrated MANPADS Simulator) is a VR/MR training system for MANPADS operators, offering realistic tactical scenarios to build precision, decision-making, and mission readiness in a secure, immersive environment.

Apart from the above products, we also take up projects under IR&D, TTIEG, MOLTI, ACSFP, ATG etc. and can provide any AR/VR, AI or Simulator Development projects.

Problem Statement:

Throughout military history, the physical environment has dictated tactical success, a principle established by Chanakya when he declared that a march must be made in accordance with the nature of the ground.

Modern warfare demand absolute precision rather than generic tactical approaches. Consequently, the 3D visualization of terrain has become a critical prerequisite for operational survival, reducing cognitive burden and allowing commanders to formulate, articulate, and execute complex strategies with absolute spatial awareness across the entire theatre of operations.

Existing Methodologies:

- **2D Maps on Paper or Screens**: They completely lack depth perception, hiding critical elevation changes and slope gradients that cause fatal navigation errors.
- **3D Maps on 2D Computer/Projection Screens**: They lack true spatial depth and force the user to constantly rotate the view, distorting relative distance and scale during high-stress decision making.
- **Physical Sand Models**: They are entirely static, take a long time to build, and cannot update with real-time intelligence or troop movements once the battle begins.

Solution:

The digitization of maps is already well established through GIS tools, satellite imagery, digital elevation models, and geospatial data platforms. However, the digitalization of mission planning activities, terrain familiarization, and sand model discussions continues to rely largely on 2D computer screens, static maps, or flat projector screens. Some newer technologies also include interactive screens and floors which also only provide a two dimensional view of the terrain.

While these systems support basic visualization, they often fail to provide true spatial understanding of terrain, elevation, line of sight, movement corridors, tactical positions, and mission dynamics. This limits the effectiveness of collaborative planning and reduces the intuitive understanding required for operational decision-making.

By leveraging emerging technologies such as XR (AR / VR / MR), Holographic visualization, Depth Sensing based Projection Mapping traditional sand model discussions can be transformed into immersive, interactive, and multi-user digital experiences. These technologies enable commanders, instructors, and trainees to visualize terrain in three dimensions, interact with mission overlays, place forces and assets, simulate movement, assess threats, and conduct collaborative planning with a far higher degree of spatial awareness.

This approach bridges the gap between conventional GIS-based map digitization and next-generation mission planning by converting static terrain data into an immersive, dynamic, and operationally relevant decision-support environment.

Available Holographic, Augmented Reality & Mixed Reality Technologies

Note: Since Virtual Reality puts users into a virtual world completely disconnected from the real world, we will be keeping it out of the purview of this research.

Holographic Technologies

1. Light Field Displays

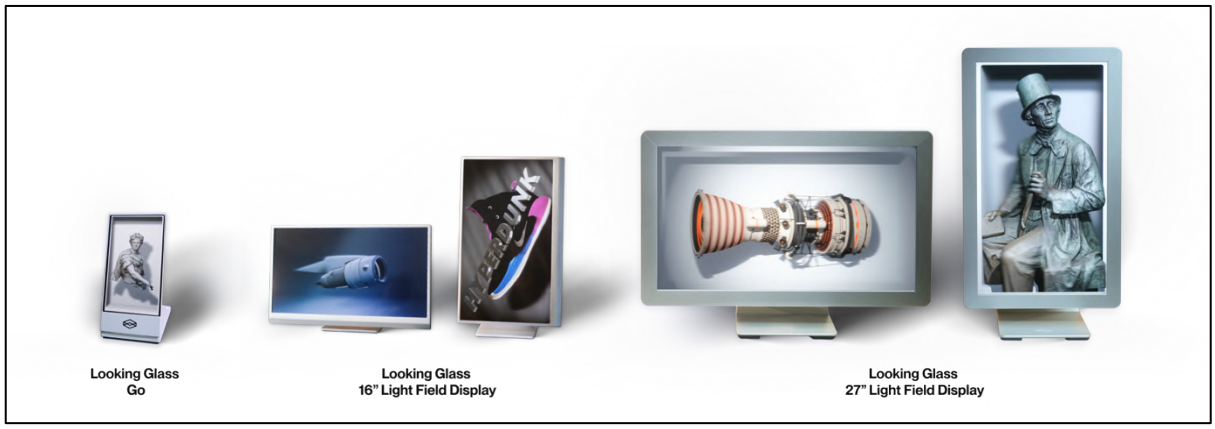
Operating Principles of Light Field Displays:

Creates a 3D viewing experience by sending different light rays in different directions, so each eye sees the object from a slightly different angle. This makes the image appear to have natural depth, similar to how we see real objects in the physical world.

Available Products in the Market:

a) Looking Glass Factory Light Field Display

Link	Features
https://lookingglassfactory.com/displays-overview	• Glass free holographic view • Objects appear inside the glass and appears in different perspectives from different angles • Multiple people can experience at the same time different perspectives based on where they are standing • 50-60 degree viewing angle • Max size is 65” • For Front Viewing only



2. Swept-Volume Volumetric Displays

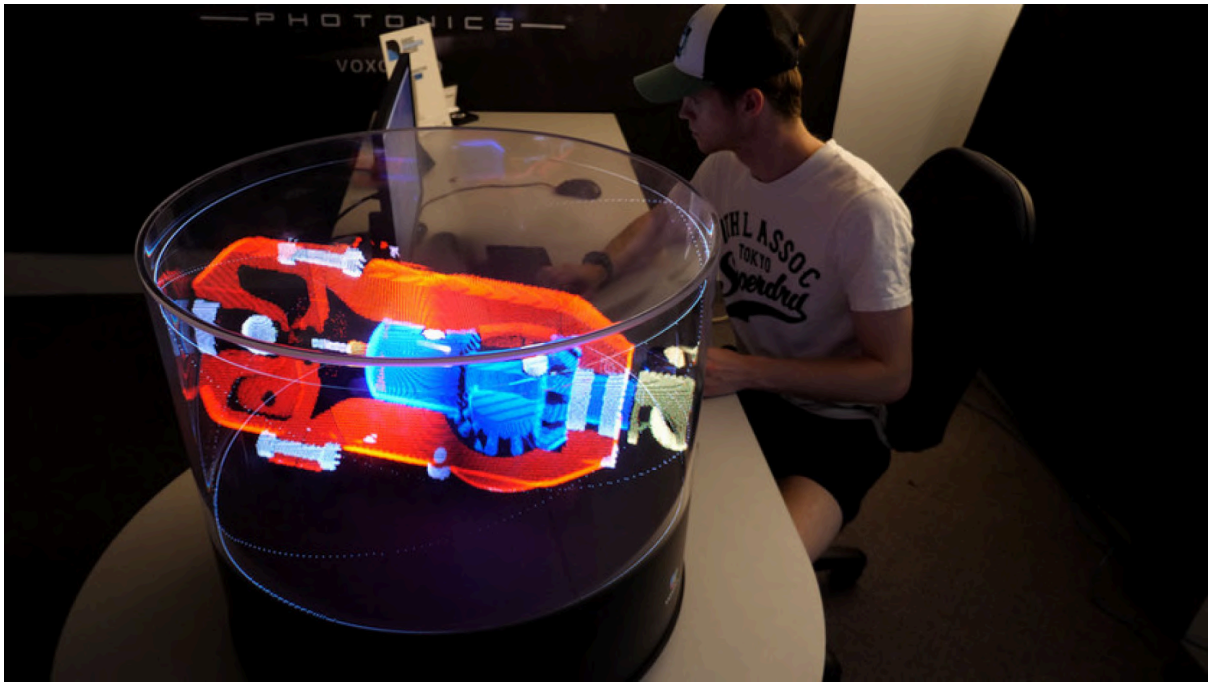
Operating Principles

A Volumetric Holographic Display that creates a 3D image by projecting many 2D image slices (cross-section) one after another onto a fast-moving or rotating screen. Because the screen moves quickly, our eyes combine these layers and see them as one floating 3D object. This is very similar to the flip book but in 3D.

Available Products in the Market:

a) Voxon Photonics

Link	Features
https://www.voxon.co/	• Glass free holographic view • Objects appear inside the glass and appears in different perspectives from different angles • Multiple people can experience at the same time different perspectives based on where they are standing • 360 degree viewing angle • Max size is 20.5 inches diameter x 10 inches height • Resolution is low and not good for closer terrain views or reading texts or even mil symbols



3. Spinning LED Fans

Operating Principles

It uses fast-rotating blades fitted with LEDs. As the blades spin, the LEDs switch on and off at precise moments to draw images in the air. Since the blades moves faster than what our eyes can track, it creates a floating hologram-like effect, but it is mainly a 2D/3D illusion, not a true 360° volumetric display.

Available Products in the Market:

a) Hypervsn and similar LED Fan products

Link	Features
https://hypervsn.com/	• Glass free holographic view • Objects appear floating in mid-air • Multiple people can experience at the same time however the perspective remains from one angle only • Front viewing only • Size can be adjusted as per requirements • Resolution is low and fine details are difficult to read/view

4. Transparent LCD Cabinets

Operating Principles

A transparent LCD is like a normal LCD screen, but without a solid opaque back panel. It allows some light to pass through, so objects behind the screen remain visible.

a) Holobox Grid by Holoconnects

Link	Features
https://www.holoconnects.com/products/hologrid/	• Glass free holographic view • Objects appear inside the glass and appears in different perspectives from different angles • Single user experience as the perspective changes based on a person's position in front of the glass. Other viewers see what the person in front sees • Front Viewing only • 86" per Holobox. Multiple Holoboxes can be combined to create larger sizes

b) HLD Display by Light Field Labs

Link	Features
https://lookingglassfactory.com/hld-overview	• Glass free holographic view • Objects appear inside the glass and appears in different perspectives from different angles • Multi user experience but perspective does not change when a person moves around it • Front viewing experience only • Available in upto 86” size and can be stacked together for larger displays

5. Autostereoscopic Monitors

Operating Principles

For individual creators, medical diagnosticians, and computer-aided design (CAD) specialists, autostereoscopic displays offer high visual fidelity without requiring headsets. These devices use integrated eye-tracking sensors to project distinct, perspective-correct left- and right-eye coordinates directly to the user

Available Products in the Market:

a) Sony Spatial Reality Display

Link	Features
https://pro.sony/en_IN/products/spatial-reality-displays/elf-sr2	• Glass Free holographic view • Objects appear coming out of the screen • Single Viewer Experience • Max size 27" but can be stacked together in grid for larger display sizes of upto 55" • Uses camera to capture a user's perspective and renders the content accordingly

b) Acer Spatial Labs View

Link	Features
https://www.acer.com/in-en/monitors/spatiallabs/acer-spatiallabs-view-pro-27	• Same as Sony Spatial reality display • Although cannot be stacked for larger sizes

c) Schneider Digital 3D PluraView

Link	Features
https://www.3d-pluraview.com/en/	• Requires user to wear Passive stereoscopic glasses (Same as the ones to be worn in 3D Movies) • Front viewing only • Multi-user experience but for only few standing near it • Field of view is - Horizontal ±25°, Vertical -40° / +20°; viewing distance 50–100 cm • One active participant only • Content appears coming slightly outside the display for depth

6. 3D Stereo Projection based Front Holographic Displays

Operating Principles

The technology works in the same way how 3D movies in cinemas work. The content is developed & rendered in stereoscopic 3d format which makes it appear coming out of the screen.

Available Products in the Market

a) Pragyatec's Holographic Wall

Link	Features
https://youtu.be/24ZpPDhHxOA	• Front Projection based technology • Requires user to wear Active Stereoscopic Glasses (similar to ones in cinemas) • Requires a dark room • Creates 3d perspective for a single active user • Multiple viewers can join the experience and visualize the content from the active user's perspective • Standard size available is 3.6m x 2m display area but can be increased if required • Content appears coming out of screen for upto 4 feet

7. 3D Stereo Projection based Table Top Holographic Displays

Operating Principles

The technology works in the same way how 3D movies in cinemas work. The content is rendered in way that it appears in 1 or 2 perspectives for upto 2 active users and appears coming above the table

Available Products

a) Axiom Holographic Table

Link	Features
https://axiomholographics.com/devices/hologram-table/	• Table Top Projection based technology • Requires user to wear Active Stereoscopic Glasses (similar to ones in cinemas) • Requires a low lit room • Creates 3d perspective for a one or two users perspectives only. • Supports 2 active users and upto 4 passive viewers can join the experience however passive viewers see from the active user's perspective • Can be seen from 360 degrees but only for the active users. Other viewers can only see the same perspective as the active user • Table size is 2.16m x 2.16m with a 1.27m by 1.27m display area. • Content appears coming above the screen As per latest updates from official partners of Axiom, this product was recently discontinued by the company due to various limitations

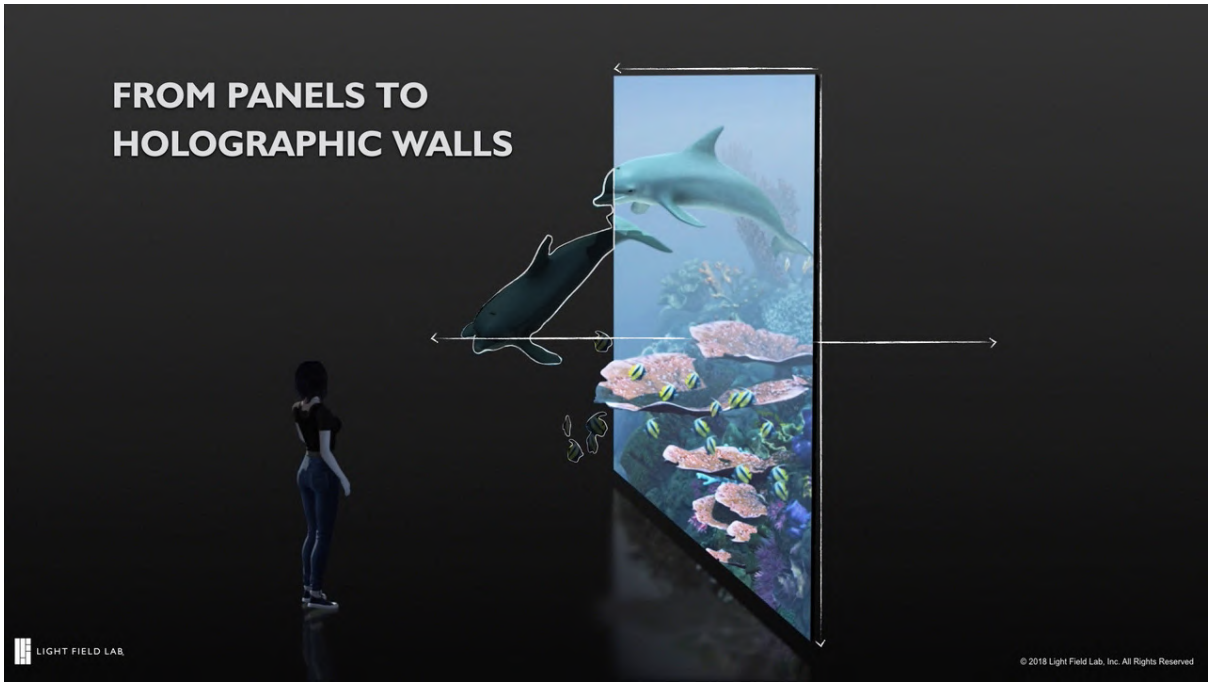
8. Solid State Volumetric

Operating Principles

This is the holy grail of Holographic Displays. They create **glasses-free true 3D / holographic light-field display**, where the screen emits many controlled light rays so the viewer sees natural depth, motion parallax, and changing perspective as they move.

a) Light Field Lab SolidLight

Link	Features
https://www.youtube.com/watch?v=-TfKbQJcbg0	• Glass Free holographic view • Being developed for front projections presently which will be extended for table top projections in future • Objects appear coming out of the screen • Multi Viewer Experience • 120 degree field of view • Being developed in 28" seamless blocks and hence can be extended for any size • Still under development and hasn't been launched publicly • Extremely expensive (millions of dollars)



b) Avalon Holographics NOVAC

Link	Features
https://avalonholographics.com/product/	• Glass Free holographic view • Available in Table Top form factor • Objects appear coming out of the screen • Field of view is 74 x 74 degrees • Multi Viewer Experience • Max size 40" and display dimension is 36" x 36" x 41"

	• Not available commercially off the shelf • Extremely expensive (millions of dollars)

Augmented Reality Technologies

These are head mounted displays which are primarily pass through glasses with a screen on the glasses to add digital content on top of real world through waveguides. Primary use cases for which AR glasses are being developed today are Remote Assistance, Handsfree Digital Overlays in industrial / enterprise settings, etc.

For the use case of sand model discussions, we require a device that is 6-DOF capable which makes them usable for spatial computing so that it can place a virtual object in real world and continuously keep tracking it so that the object appears as part of the real world

Benefits:

- Transparent glasses for a true real world experience so the user does not feel being away from reality
- Less Bulkier
- Very little to no nausea
- Great for Digital content overlayed on top of real world

Limitations:

- Limited field of view on current gen devices: 30 to 55 degrees max
- They have lesser processing capabilities as their use-case is not simulations or 3D renderings.

- Has limited sensors & cameras and hence still not as effective as Mixed Reality glasses when it comes to 6-DOF tracking of objects

1. Microsoft HoloLens 2 & Magic Leap

These devices used Augmented Reality along with Depth Sensors such as Lidar to provide an immersive merging digital content in real world.

While both these devices were great for our use-case, they have now been discontinued by the OEMs.

2. RayNeo, Vitura, INMO, Rokid, Lenovo etc.

All are Chinese companies and hence kept out of scop of this research

3. Digilens ARGO

These are the most promising presently available AR Glasses for the table-top sand model discussion use case.

- It has built-in inside out tracking similar to mixed reality devices which will help us place virtual objects in realworld.
- However being primarily AR glasses, they have limited rendering capabilities and cannot render high quality 3D terrains as well as what Meta Quest 3 or Apple Vision Pro could do.
- This is a MIL-STD-810G device and also IP65 Rated
- Field of view is very low ~30 degrees
- Link: https://www.digilens.com/argo/

4. Tilt Five

These glasses uses a unique approach to create holograms on tables. These are primarily built for table top displays with very high field of view and high resolution. The glasses project light on a specially crafted board which reflects the light back at the user for viewing holograms

- They transparent glasses so user is not viewing the world through camera passthroughs similar to the mixed reality devices.
- Max size for the display can be 31” x 42” on top of a table. The devices are slightly bulkier than other AR glasses.
- There is also a joystick want to interact with the digital content.
- They however are not standalone devices and requires a connection with a laptop / pc and also are limited to 4 people connecting over a discussion.
- Link: https://www.tiltfive.com/

5. Snap Spectacles 2026

These are upcoming AR Glasses with a promise to be good enough for 3D rendering workflows. However whether they will be good enough for sand model discussions is yet to be seen.

- Link: https://www.spectacles.com/

6. Meta AR Orion

These are upcoming true AR goggles to be launched in 2027

Mixed Reality Technologies

These are devices that uses cameras to show the video passthrough of the real world instead of seeing directly through transparent glasses. Primary use cases include premium spatial computing, immersive MR, 3D visualization, training, design review.

Benefits:

- Very High Field of view of upto 120 degrees giving sense of true blending of real world with virtual content
- True to life holographic experience

Limitations:

- Bulkier headsets
- Instead of seeing world through

1. Apple Vision Pro

- Extremely high resolution
- Excellent hand tracking
- Excellent 3D rendering capabilities
- Costly
- Can create holograms of sizes upto 15x15 feet

- Link: https://www.apple.com/apple-vision-pro/

2. Meta Quest 3

- Very High Resolution
- Very Good Hand Tracking & Excellent Hand Controller
- Very High 3D rendering capabilities
- More affordable
- Very good SLAM tracking
- Can create holograms of sizes upto 20x20 feet
- Link: https://www.meta.com/in/quest/quest-3/

3. HTC Vive Focus Vision

- All features similar to Meta Quest 3 with resolution slightly better than Meta Quest 3
- Link: https://www.vive.com/us/product/vive-focus-vision/overview/

4. Varjo XR-4

- Extremely high resolution
- Very Bulky
- Requires a PC / Desktop to work with
- Excellent pass through visuals
- Very good for SLAM tracking
- Link: https://varjo.com/

Summary

S.No	Product	Remarks
Holographic Devices		
1	Looking Glass Factory Light Field Display	Although a multi-perspective experience, it is front viewing display with object appearing inside the box and hence not recommended for the use-case of sand model discussions using holograms
2	Voxon Photonics	360 viewing experience however the display not being sharp and also size is smaller hence not recommended as primary display for sand model discussions using holograms but can be considered as supplementary display.
3	Hypervsn LED Fans	Singe perspective experience so not recommended for Sand Model Discussions.
4	Holobox Grid	Multi perspective but for front viewing and single user experience. Hence not recommended for sand model discussions.

5	HLD Display by Looking Glass Factory	Single Perspective experience with front viewing capability only. Hence not recommended for sand model discussions.
6	Sony Spatial Reality Display	Multi-perspective display with front viewing capability only and for only single user hence not recommended for sand model discussions.
7	Acer Spatial Labs Display	Multi-perspective display with front viewing capability only and for only single user hence not recommended for sand model discussions.
8	Schneider PluraView Display	Multi-perspective display with front viewing capability only and for only single user hence not recommended for sand model discussions.
9	Holographic Wall by **Pragyatec**	• Multi-viewer experience and visible from different perspectives. • However view visible from single viewer's perspective is only possible • Size is good and requires a slightly darker room • Recommended for Sand Model briefings only but not ideal for interactive discussions with multiple active participants
10	Holographic Table by Axiom or Custom Developed by **Pragyatec**	• Multi-viewer but view visible from max two viewer's perspectives • Only Upto 4 additional viewers (2 for each active user) can have a decent experience. Beyond which the experience deteriorates rapidly • Recommended for small groups only and for smaller terrain visualization • Table by Axiom has been discontinued • Table can be custom built if required
11	SolidLight by LightField Labs	• True Holographic Display but still an R&D Project and is extremely expensive • Pricing is not publicly avl but research says it'll be a few million dollars.

12	NOVAC by Avalon Holographics	• True Holographic Display for Table Top Discussions but still an R&D Project and is extremely expensive • Pricing is not publicly avl but research says it'll be a few million dollars. • Size is limited to 40"
Augmented Reality Devices		
1	HoloLens 2 or Magic Leap	Discontinued hence not recommended
2	Products by RayNeo, Vitura, INMO, Rokid, Lenovo etc.	Chinese products hence not recommended. Also most products are not suited for the use-case as they are not meant for spatial computing. Also field of view is restricted to max 50 degrees.
3	ARGO by DigiLens and similar products	Spatial Computing capable device but with limited processing and very low field of view of 30 degrees which will not provide a good terrain viz for sand model discussion.
4	Tilt Five	A unique projection device that projects on a specially crafted mat to provide a holographic experience. These however requires a connection with an external device as it does not have its own processing capabilities. Size is restricted to 41" and max users is restricted to 4
5	Snap Spectacles & Meta Orion	Not Launched yet but looks promising. Whenever they are launched, Prototype can be developed & evaluated
Mixed Reality Devices		
1	Apple Vision Pro	Excellent Resolution along with very high field of view providing a truly immersive experience. Recommended for Mixed Reality based discussions on Sand Models.
2	Meta Quest 3 or HTC Vive Focus Vision	Lower resolution from Apple Vision pro but similar experience in terms of immersiveness.

		Recommended for Mixed Reality based discussions on Sand Models when budgets are lower. It also comes with its own controllers which is a plus over Apple Vision Pro models.
3	Varjo XR4	Not recommended due to heavy size and it is also not wireless

Additional Information

Mixed Reality vs Augmented Reality View

- https://www.youtube.com/watch?v=4eFIGfxNyIQ

iNaksha Mixed Reality Display

- https://www.youtube.com/watch?v=bnH6Spg--7I

Advantage of Head Mounted based display over Common Holographic Displays

An advantage of head mounted display based technologies i.e. Mixed Reality or Augmented reality based solutions is that each user gets to work independently and then share their perspectives at the appropriate time.

This is not true for projection / screen based display technologies producing holograms unless the hologram itself is created independently by each user. Even if a multi-viewer holographic displays is used, all users essentially sees a common view of the terrain.

Non Immersive / Fixed Solutions for Sand Model Discussions

While this white paper presents a range of hardware options available for immersive sand model discussions, certain use cases—particularly those involving a fixed Area of Responsibility (AOR)—may also require non-immersive and fixed sand model solutions.

Such solutions enable terrain content to be projected onto fixed physical structures, allowing terrain visualisation without the need for specialised immersive devices. This makes them suitable for scenarios where the operational area remains constant and the primary requirement is shared visual reference rather than individual immersive interaction.

However, a key limitation of fixed sand model solutions is their restricted ability to support dynamic terrain interaction, particularly zooming and detailed exploration of varying terrain scales. Despite this limitation, when used in conjunction with immersive sand model solutions, they can complement each other effectively. Together, fixed and immersive solutions can provide a more comprehensive and optimal environment for detailed sand model discussions, combining shared physical visualisation with interactive and immersive terrain exploration. For more details on this, please reach out to us at info@pragyatec.com