SKYMESH
3D

THE FUTURE OF 3D SCANNING
IN VFX & 3D ANIMATION

FROM PERFORMANCE TO DIGITAL DOUBLE

Discover how 3D scanning is transforming the future of visual effects—one character, one set, one scene at a time.

2025

MILESTONEDIGITAL.IO/SKYMESH3D

INTRODUCTION

Visual effects are no longer built from imagination—they're captured, scanned, and brought to life with dimensional precision.

VFX has always been about illusion—but modern audiences expect more than smoke and mirrors. Today, realism means accuracy. Depth. Presence. And that's where 3D scanning is changing everything. From blockbuster facial captures to textured digital doubles, visual effects studios are using reality as a creative asset, capturing real-world surfaces, structures, and performances with incredible detail.

Whether it's scanning a prop, a face, a set, or an entire location, 3D scanning gives artists and supervisors the data they need to ground their effects in physical truth. The result is faster integration, more believable composites, and fewer costly surprises in post. In a pipeline driven by speed and quality, scanned assets allow teams to work smarter, not harder.

With new tools entering the market—from handheld LiDAR to volumetric stage capture—VFX workflows are evolving. We're no longer modeling from scratch. We're starting from the source, sculpting from reality, and extending it frame by frame.

This book explores how scanning is becoming the foundation for digital production. From the tools being used to the workflows being reimagined, we'll explore how 3D scanning is shaping the future of visual effects—scene by scene, scan by scan.
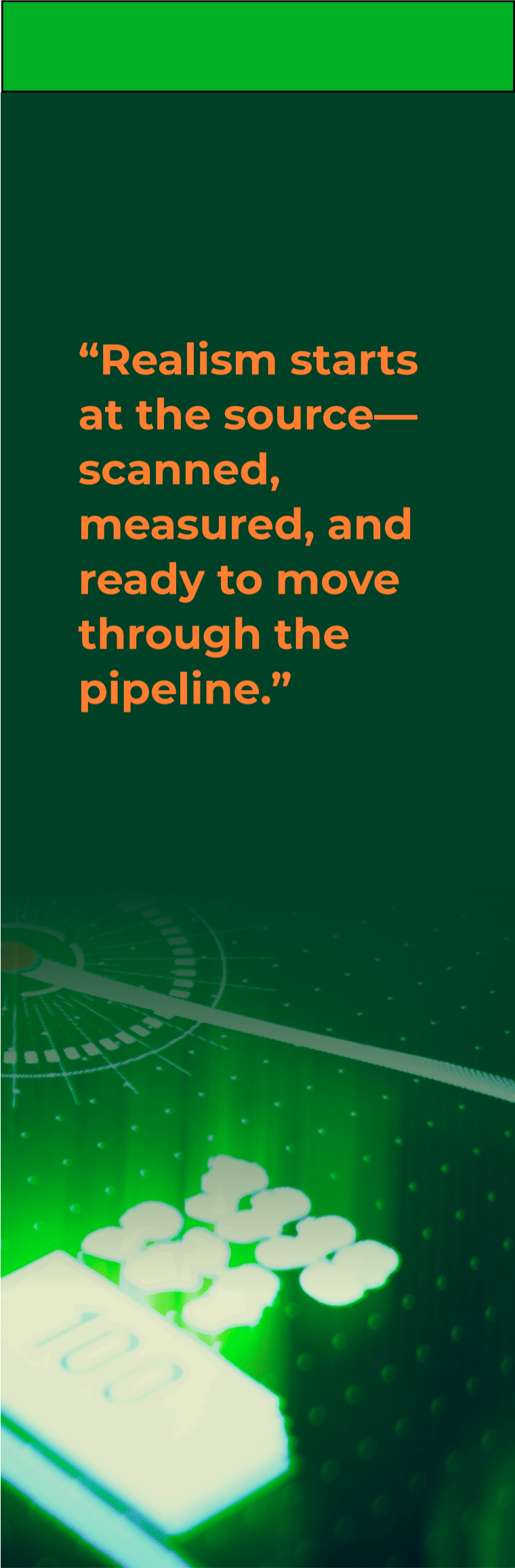
"In visual effects, precision isn't optional—it's the difference between illusion and immersion."

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"Realism starts at the source— scanned, measured, and ready to move through the pipeline."

CHAPTER ONE
WHY VFX STUDIOS ARE TURNING TO 3D SCANNING

Visual effects used to rely on a blend of digital modeling, photogrammetry, and hand-keyed magic. Today, the industry is shifting—quickly—toward direct data capture. What once took days of modeling can now be scanned in minutes, with sub-millimeter accuracy, and dropped straight into a VFX pipeline.

From faces to full-body scans, set extensions to destroyed buildings, scanning makes visual effects more realistic, faster to produce, and easier to composite. It eliminates guesswork and gives artists a precise reference for lighting, scale, texture, and integration.

Realism That Begins with Reality

VFX audiences can spot fakes. They may not know why something looks off—but they know when it does. Scanning changes that by grounding CG in real-world data. A digitally scanned prop has authentic wear patterns, dents, and surface imperfections. A scanned face holds the asymmetry and micro-contours that make a digital double feel alive.

Whether for film, TV, games, or virtual production, **scanned assets provide the subtlety and nuance** that handcrafted models often lack.

Speed and Precision in the Pipeline

In production, time is always short—and every minute counts. Scanning dramatically reduces modeling time while boosting accuracy. A building facade that might take a week to model by hand can be scanned in a day, cleaned, and delivered for layout the same week. Actors can be scanned between takes and inserted into action shots, reshoots, or digital environments.

Studios using 3D scanning report **fewer revisions, faster approvals, and more flexibility** in their visual storytelling.

Modular, Reusable Assets

Scanned assets aren't just single-use—they're library-ready. Once captured, a model can be retextured, relit, or modified for countless other projects. A crumbling brick wall becomes part of a war zone, a fantasy castle, or a dystopian backdrop. A scanned street becomes a shared environment for multiple scenes. That means more efficient pipelines and stronger continuity between departments and productions.

Realism That Begins with Reality

Modern VFX isn't just about cool visuals—it's about smart data. Scans can feed into everything from previz and environment layout to animation reference and physics simulations. By integrating scan data early, studios avoid scaling issues, mismatched lighting, and inconsistent geometry that would otherwise surface during post.

Whether it's a creature replacement, a CG stunt double, or a full environment, 3D scanning supports the entire VFX lifecycle—from shoot to screen.

When to Scan, When to Model

3D scanning isn't a one-size-fits-all solution. While it offers unbeatable speed and realism in many situations, traditional modeling still has its place—especially when the goal is creative flexibility or stylized control. Knowing when to scan and when to build from scratch is part of mastering the modern VFX workflow.

Scan it when:

- The object is complex, organic, or highly detailed (e.g., a costume, creature maquette, or aged prop)

- Time is tight and accuracy is critical

- You need a real-world match for lighting, deformation, or simulation

- The asset won't change much between shots

Model it when:

- The object is modular, mechanical, or geometric (e.g., a sci-fi panel or repeating structure)

- You need to animate or break it apart in ways the scan wouldn't support

- You're working in a stylized, non-photoreal visual language

- File size and optimization outweigh realism

Blending scanning with modeling gives studios the best of both worlds—speed and accuracy when needed, and creative freedom when it counts. Chapter 2 dives into how these choices play out across common VFX workflows.
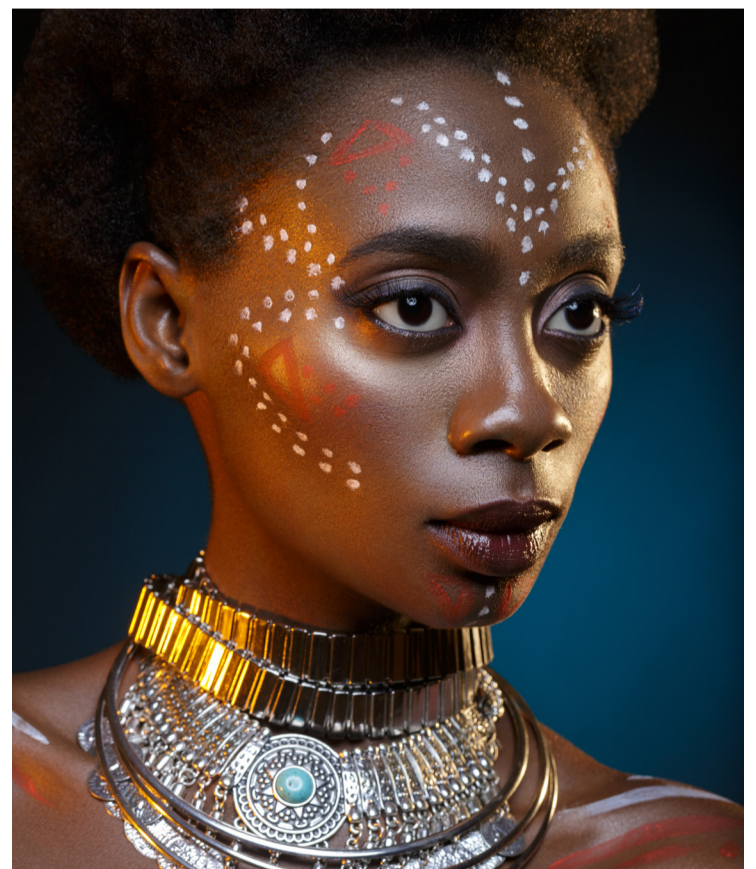
What's Next

In the next chapter, we'll break down the most common scanning workflows used in visual effects today. From full-body scans to location mapping, we'll show how data moves from real world to rendered frame—and where you can fit it into your own production process.

"

"It's incredibly difficult to fake weight, wear, or weather. Scanning gives CG the truth it needs to look real."

In the world of visual effects, believability lives in the details—the scuff on a boot, the fold of a costume, the way light grazes a surface at the wrong angle. 3D scanning brings those elements into the digital realm with precision and speed. What once required days of modeling or texture painting can now be captured on set in a matter of minutes using modern handheld scanners like the Artec Leo or Peel 3.

For VFX teams, this means tighter turnarounds, more accurate integration, and fewer late-stage revisions. Scans of actors, props, and environments become the foundation for everything from digital doubles to set extensions and FX simulations. They don't just fill in the gaps—they ground the entire shot in something real. With that kind of truth in the pipeline, even the most ambitious effects can stick the landing.

CHAPTER TWO
CORE SCANNING WORKFLOWS IN VFX

3D scanning in VFX isn't one-size-fits-all—it's a collection of specialized workflows, each tuned to a different type of creative challenge. Whether capturing a digital double, rebuilding a destroyed set, or prepping for a game cinematic, today's VFX teams rely on scanning to bridge the gap between physical performance and digital execution.

In this chapter, we'll break down the most widely used scanning workflows in visual effects, from full-body actor capture to large-scale environment scans, and show how each integrates into production pipelines.

Character & Costume Scanning

Perhaps the most common use of scanning in **VFX is the full-body character scan**. Actors, stunt doubles, and background performers are scanned in T- or A-poses using structured light or LiDAR scanners. Clothing, gear, and props are captured with surface-level detail and texture, giving modelers a perfect base for rigging and animation.

These scans are often used to create:

- **Digital doubles** for stunts or crowd scenes
- **Freeze-frame destruction shots**
- **Clean plate subtraction** for costume changes or makeup fixes

Example: A lead actor is scanned in costume between scenes, allowing the VFX team to extend a mid-air jump into a slow-motion CG sequence.

"Full-body scans provide a high-fidelity foundation for rigging, simulation, and digital double integration."

Environment & Set Scanning

When a location or practical set needs to be extended digitally, **environment scans** are used to map the geometry of the real world. LiDAR or photogrammetry systems capture building facades, terrain, roads, and architectural details. This ensures digital extensions match lighting, perspective, and scale.
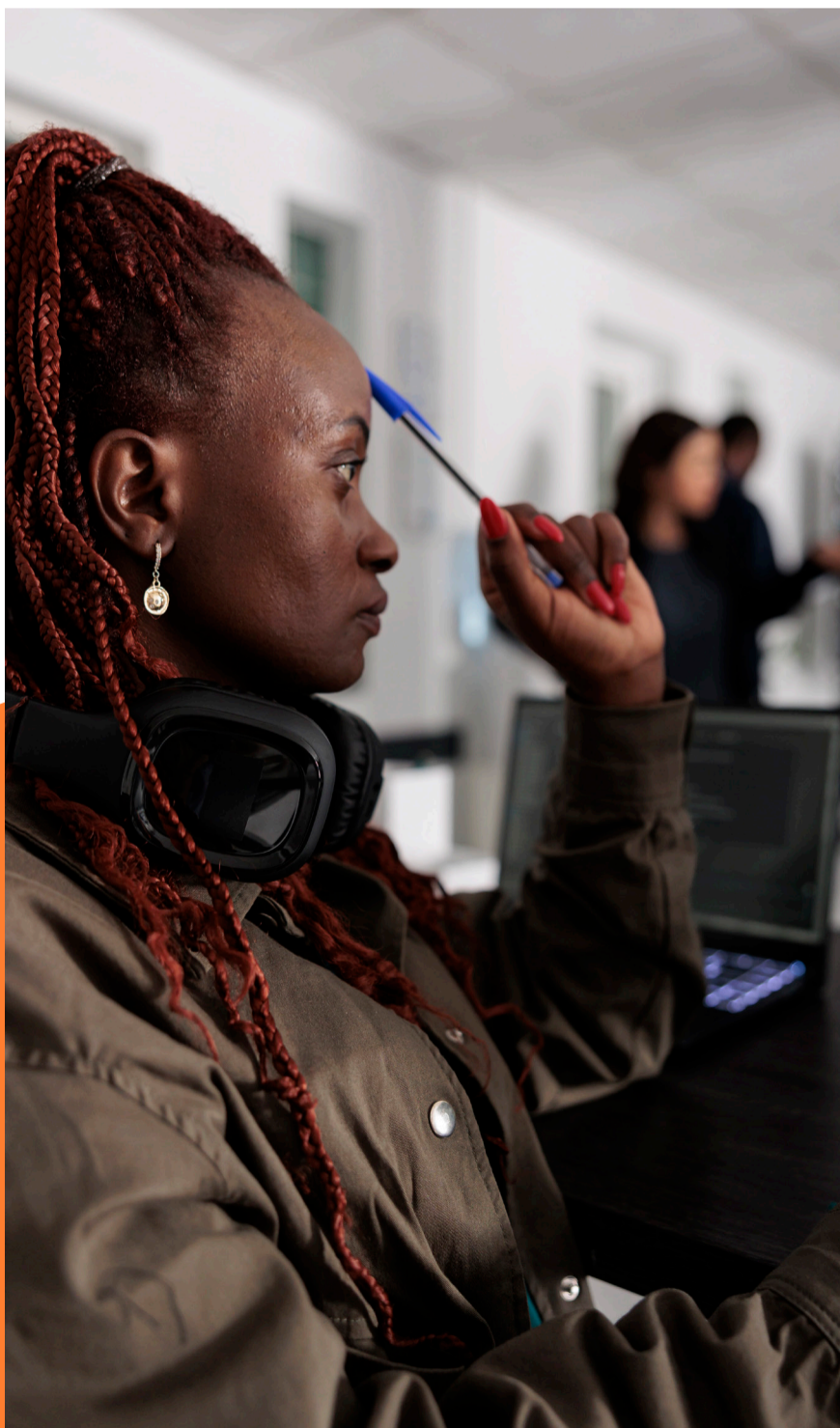
Common outputs:

- Clean geometry for digital matte painting
- Accurate reference for lighting and tracking
- Full-scale set extensions

Example: A city alley is scanned with LiDAR to blend seamlessly into a larger CG battlefield during a 360° camera move.

Real World Scenario: On a high-budget sci-fi production, the lead actor performed a wire-assisted leap across a rooftop. To extend the stunt in post, the VFX team used a structured light scanner to capture the actor in costume between takes. The scan provided a rig-ready digital double, allowing animators to stretch the jump into a slow-motion arc while preserving every detail of the actor's form, clothing, and silhouette. The result: a seamless blend of live-action and CG with no need for reshoots.

Before cameras roll, a VFX artist walks the set with a handheld scanner in hand, examining angles, lighting conditions, and key props the actor will interact with. She's here to capture every physical detail—costume folds, facial structure, and the surrounding environment—with precision. By scanning the actor in costume on location, she ensures the digital double will match the live footage down to the millimeter.

In visual effects, continuity is everything. Scanned data allows artists to replicate lighting, scale, and interaction realistically—especially in high-impact scenes that require augmentation, extension, or full CG replacement. The mesh becomes more than a model—it's the backbone of the digital performance, bridging the gap between shoot day and final composite.

On-Set Asset Capture

VFX teams often scan props, weapons, costumes, and hero objects while on location. This allows for quick integration into CG or animation pipelines without waiting on modeling or photogrammetry cleanup.

Handheld scanners are ideal for this task because:

- They're fast and portable

- Require minimal setup

- Work in tight or cluttered spaces

Example: A sci-fi weapon is scanned on set so it can be digitally re-animated to spin, split open, or emit VFX lighting in post.

Reference & Performance Capture

Sometimes scans aren't used directly in the final shot—they're used as **reference** to inform animation, lighting, and physics. Facial scanning and full-body rigs provide data on expression, proportions, and physical structure, which animators can use to maintain realism throughout a sequence.

Scanned characters and props can also be used for:

- Muscle simulation

- Cloth dynamics

- Lighting calibration

Example: A body scan of an actor is used to fine-tune how a digital cape interacts with wind and movement in a CGI render.

Hybrid Workflows for Realism

Just like in architecture and land development, VFX workflows increasingly combine **aerial drones, handheld scanners, and camera-based photogrammetry** to create a single, unified digital environment. This multi-source approach is especially powerful in virtual production, where physical and digital worlds must blend seamlessly in real time—often on massive LED volumes.

By combining data sources, studios benefit from the high-precision geometry of LiDAR, the rich texture and color data of photogrammetry, and the mobility and close-range detail captured by

handheld structured light scanners. For example, a mountain range might be scanned from above using drone LiDAR, while the base camp set is captured with a handheld scanner to preserve prop detail and terrain interaction. Photogrammetry fills in texture gaps and enhances material realism across the entire model.

In post, these data sets are aligned and optimized within software like RealityCapture, CloudCompare, or Unreal Engine, creating a hybrid model that is both efficient and photoreal. The result is a modular, editable environment that can be relit, retextured, and reused across sequences—without the need to constantly rescan or remodel from scratch.

Hybrid workflows also give production teams more flexibility during principal photography. Real-world locations can be scanned ahead of time and projected live on LED stages, allowing directors to block scenes with true-to-scale environments even when the actual set is thousands of miles away. For stunt-heavy or VFX-intensive shoots, this hybrid approach ensures continuity, speed, and realism—without compromising creative control.

As scan quality improves and software pipelines become more streamlined, hybrid scanning isn't just a clever workaround—it's fast becoming the new standard for building high-impact, physically grounded visual effects.

Suggested Workflow Snapshot:

Type of Scan	Hardware	Output	Use Case
Full-body actor	Artec Leo, Eva	OBJ + texture maps	Digital doubles
Environment	LiDAR drone, terres-trial laser scanner	Point cloud + mesh	Set extension
On-set props	Handheld scanner	OBJ, STL	Hero asset integra-tion
Facial capture	Structured light or photogrammetry rig	PLY + blend shapes	Performance-based VFX

Making the Workflow Work

Behind every believable VFX sequence is a well-planned scanning workflow. Whether scanning a character, a prop, or an entire set, the tools you choose—and the order in which you use them—make a major difference in efficiency and accuracy. While every production has unique challenges, most studios rely on a few core scanning setups that have become proven standards across the industry.

For digital doubles, a handheld scanner like the Artec Leo is used to capture the actor's body and costume in high detail. This is typically done on set or in a scanning booth between takes. The resulting OBJ or STL file is passed into cleanup and retopology software such as ZBrush or Blender, where it's prepared for rigging, simulation, and animation. Textures are either baked directly from the scan or reprojected for realism under VFX lighting conditions.

Prop scanning is often faster but equally critical. Small hero items—like weapons, helmets, or handheld gadgets—are scanned with portable units and meshed on site or in studio. These assets are frequently dropped into layout scenes or particle simulations, and can be reused across sequences.

For larger environments, drone photogrammetry or terrestrial LiDAR scanning is deployed before or after principal photography. Scans are processed through RealityCapture or CloudCompare, giving artists precise models for set extensions, matte painting geometry, and camera tracking reference. These scans can be exported in formats like PLY or FBX for quick ingestion into Unreal Engine or Maya.

Each of these workflows feeds the larger goal: creating assets that are visually consistent, technically accurate, and production-ready. By developing scanning pipelines that align with your studio's tools and timelines, you can integrate real-world data into your VFX shots with confidence—and without delay.

What's Next?

Next, we'll explore the specific tools of the trade—from capture gear to processing software—and how to choose the right combination for your team's workflow, budget, and creative goals.

CHAPTER THREE
TOOLS OF THE TRADE – HARDWARE, SOFTWARE & FORMATS

The best results in 3D scanning don't just come from the gear—they come from the right combination of tools, tuned to the specific demands of a VFX pipeline. In this chapter, we'll break down the key hardware used on set and in studio, the software that processes scan data into usable assets, and the formats VFX teams rely on to integrate scans into animation, compositing, and virtual production.

Handheld Scanners – Ideal for Props, Characters, and Costumes

Handheld structured light scanners are a go-to for capturing **high-resolution surface geometry and textures**. These devices are portable, fast, and capable of scanning in tight on-set spaces with minimal setup.

Top Picks:

- Artec Leo – Wireless, high-res, real-time preview; ideal for scanning actors and gear

- Artec Eva – Lightweight, highly accurate for costume and facial capture

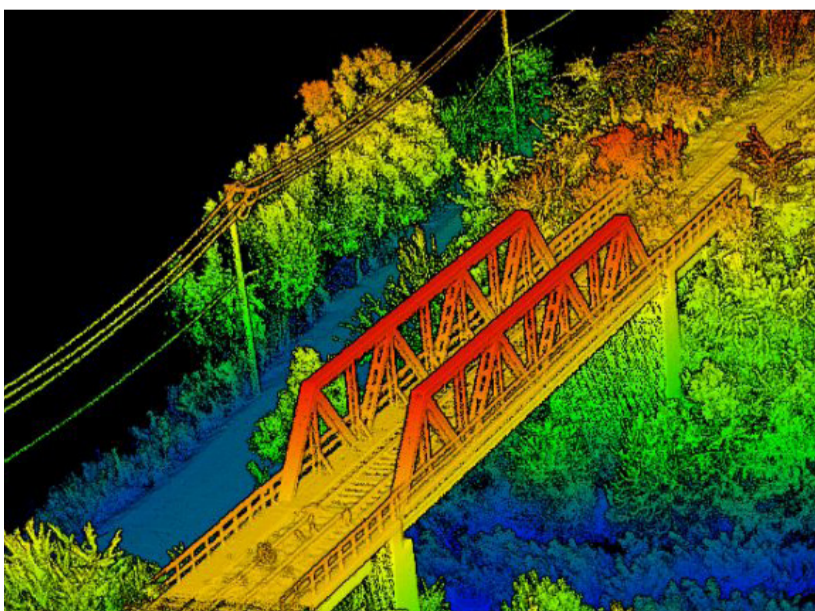- Peel 3 – Budget-friendly with solid surface detail for props and body scans

IMAGE SOURCE: C2MI.CA

LiDAR & Photogrammetry – Built for Scale and Texture

When large-scale accuracy or rich texture mapping is required, VFX studios turn to **LiDAR and photogrammetry.**

- **LiDAR** provides millimeter-precise point clouds—ideal for full set scans, terrain, and architecture

- **Photogrammetry** creates textured meshes from dozens (or hundreds) of photos—perfect for realistic material reproduction
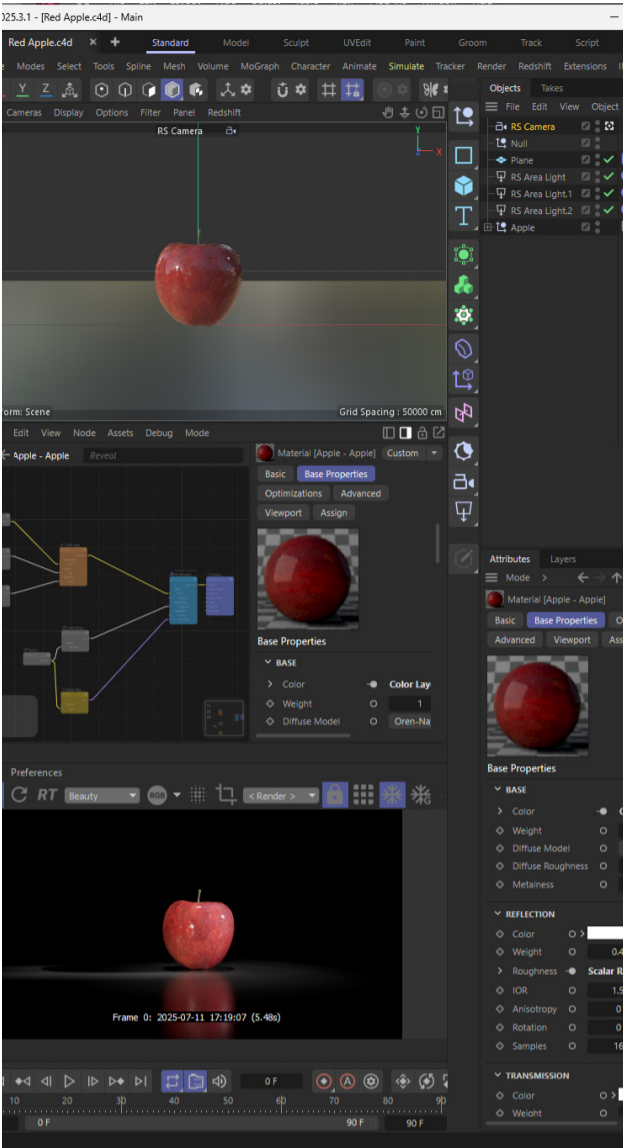
Common Tools:

- **Leica BLK360** – Fast terrestrial scanner with colorized output

- **DJI Mavic 3 Enterprise + RTK** – Drone-based scanning with photogrammetry and terrain modeling

- **RealityCapture or Agisoft Metashape** – Software for stitching and processing photos into dense point clouds

Polishing the Scan – Software That Brings Raw Data to Life

Once a 3D scan is captured, it's far from production-ready. Raw scan data often includes excess geometry, misaligned points, and resolution artifacts that must be cleaned, meshed, and optimized before it can be used in Maya, Houdini, Unreal Engine, or any downstream VFX workflow. The software listed here plays a critical role in bridging that gap—each tool offering a specific strength depending on the scan type, asset purpose, and pipeline budget.

For character and prop work, tools like Artec Studio and ZBrush offer robust cleanup and sculpting tools to refine detail and prepare assets for rigging. On the environmental side, RealityCapture and CloudCompare allow artists to process large-scale LiDAR and photogrammetry data into clean, aligned point clouds and textured meshes. For indie or budget-conscious studios, Meshroom offers a capable open-source alternative that can handle photogrammetry workflows without breaking the bank. Whether you're building a high-res digital double or a citywide scan for virtual production, these tools are the unsung heroes behind every clean, believable asset on screen.

Processing Software – Turning Scans into Production Assets

After scanning, the raw data must be cleaned, aligned, meshed, and optimized for use in 3D apps like Maya, Houdini, or Unreal Engine. Here's a breakdown of commonly used post-processing tools:

Software	Use	Best For
Artec Studio	Cleanup + meshing	Handheld character scans
RealityCapture	Photogrammetry stitching	Textured meshes, locations
Meshroom	Open-source photogrammetry	Budget pipelines
CloudCompare	Point cloud editing	Aligning LiDAR data
ZBrush / Blender	Retopology + detailing	Prep for rigging + animation

File Formats That Matter in VFX

Format	Use	Notes
.OBJ	Universal mesh format	Great for characters and props
.FBX	Rigged and animated assets	Standard for Unreal/Maya
.PLY	Dense meshes with vertex color	Common in photogrammetry
.ABC (Alembic)	Geometry cache	Animation and scene baking
.USD / .USDZ	Scene interchange + AR	Gaining popularity in virtual production

Matching Tools to Creative Needs

Task	Hardware	Software	Format
Actor scanning	Artec Leo	Artec Studio	OBJ + texture
Prop capture	Peel 3	MeshLab, Blender	STL, OBJ
Set scanning	BLK360 + Drone	RealityCapture	PLY, FBX
Crowd elements	Photogrammetry rig	RealityCapture + ZBrush	FBX, USD

Best Practices for VFX Scanning Teams

- **Plan ahead** – Know what resolution and format you'll need before scanning

- **Scan neutral + action poses** – For rigging and deformation

- **Capture references** – Lighting, color charts, camera metadata

- **Always back up raw data** – High-res assets can't be easily recreated

What's Next?

Now that you know the tools, the next chapter looks at where scanning is taking us next—from real-time virtual production to fully scanned performance doubles that blur the line between actor and algorithm.

SkyMesh 3D: Precision Scanning for Artists Who Build Worlds

SkyMesh 3D bridges the gap between real-world performance and digital storytelling. Whether you're crafting a photoreal digital double, extending a set, or building a scan-ready environment for virtual production, we deliver high-resolution, production-optimized 3D assets tailored to VFX pipelines. Our hybrid workflows—combining drone LiDAR, handheld structured light, and photogrammetry—ensure that every scan meets the scale, resolution, and realism your project demands.

We work side-by-side with artists, supervisors, and VFX teams to capture what matters most: performance, detail, and accuracy. From on-location character scanning to full-environment capture, we provide clean, ready-to-use data that integrates seamlessly into Maya, Unreal Engine, Houdini, and beyond. Whether you're solving a technical challenge or elevating visual realism, SkyMesh 3D gives you the tools to move faster—and make every pixel count.

CHAPTER FOUR
FUTURE APPLICATIONS – FROM DIGITAL DOUBLES TO VIRTUAL PRODUCTION

3D scanning isn't just streamlining VFX pipelines—it's redefining the boundaries of what's possible on screen. With improvements in real-time rendering, volumetric capture, and procedural workflows, scanning is now at the heart of everything from stunt-safe digital doubles to LED-stage virtual production. As the demand for hyper-realism grows, so does the need for accurate, ready-to-use digital assets.

This chapter explores where 3D scanning is headed in the VFX world—and why it's becoming the backbone of the next creative frontier.

Digital Doubles Are Getting Smarter

Today's digital doubles don't just resemble actors—they move like them, react like them, and even perform stunts on their behalf. **3D scans combined with motion capture and machine learning** are now being used to create photoreal characters for fight scenes, crowd shots, and de-aging.

As facial capture rigs improve and body scanning becomes faster, digital humans are becoming believable at closer distances and in more dynamic environments—without compromising performance or realism.

Virtual Production Starts with Scanning

Virtual production has rapidly gone from niche to norm. LED walls, Unreal Engine, and real-time rendering tools allow filmmakers to shoot scenes in fully digital environments without leaving the stage. But those environments don't appear out of thin air—they're built from scanned locations, props, and assets.

Whether it's a mountain ridge, a historic alleyway, or the interior of a spaceship set, scanning ensures the virtual world behaves like the real one—with accurate scale, lighting, and material response.

Real-Time Scanning & On-Set Feedback

Emerging tools are making real-time scanning increasingly viable. **Portable scanners** now offer instant previews, while **AI-assisted meshing** and alignment speed up post-processing. This gives supervisors and directors the ability to see assets in 3D on set, approve them in context, and reduce the need for reshoots or cleanup later.

Studios are beginning to use scanning during the shoot day—not just before or after—to capture

references, troubleshoot environments, or create last-minute digital doubles for VFX coverage.

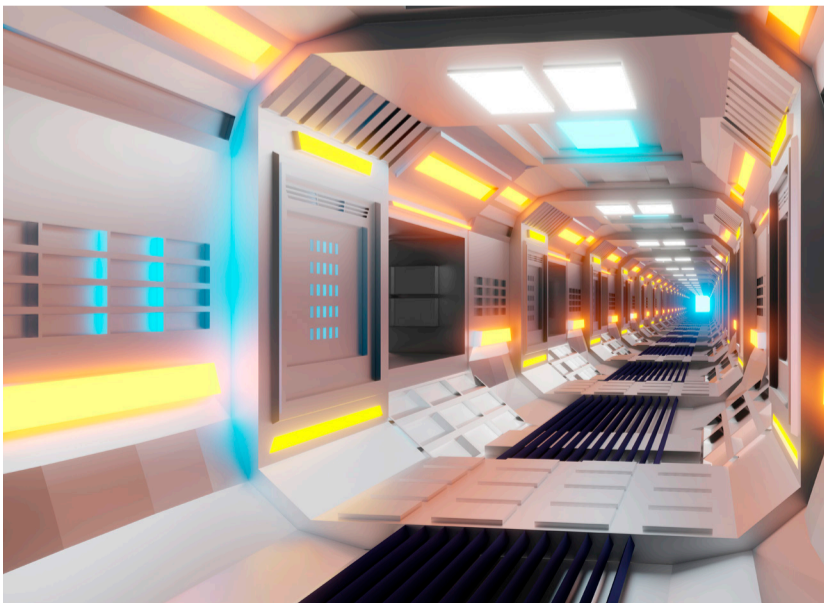## *Shared Asset Libraries & Cross-Pipeline Efficiency*

Scanned assets are becoming a production currency. Environments captured for one film can be retextured and repurposed for another. Character scans become long-term rigged assets for sequels or cinematic universes. Studios are building scanned libraries of everything from crowd extras to vehicles, accelerating timelines and maintaining continuity across productions.

As cloud collaboration and asset sharing improve, these **digital libraries** will be accessible across global teams—bringing modular production into the mainstream.

What's on the Horizon?

Emerging Trend	Impact
Volumetric capture stages	Fully immersive 3D performance scans for use in XR, games, and VFX
AI-assisted retopology	Reduces manual modeling time for scanned characters
Scan-to-rig automation	Rig-ready models directly from body scans
Live scan integration in Unreal Engine	Instant deployment into virtual production scenes

What's Next?

To bring it all together, we'll look at a real-world VFX case study showing how scanning was used to create a complex CG sequence—from initial capture to final render—and how it saved time, added realism, and gave the team more flexibility in post.

CHAPTER FIVE
SCAN → DESIGN → DELIVER
(CONCEPT DEMONSTRATION)

While this example is fictional, it represents a highly achievable workflow using current tools and processes.

In fast-paced visual effects production, time, accuracy, and realism are everything. This case study follows a high-pressure action sequence where environment scanning played a critical role—from on-location capture to final composite—and shows how SkyMesh 3D workflows enabled the VFX team to work smarter, faster, and with greater creative control.

The Challenge: Ancient Ruins Too Fragile for Action

A production team was tasked with filming a dramatic chase sequence through ancient ruins for a historical adventure film. However, due to preservation laws and structural instability, the real location could not be used for stunts, physical interaction, or destructive effects. The director wanted dynamic camera moves, collapsing debris, and close-quarters action—all within the authentic geometry of the site. Digitally recreating the ruins was the only viable path forward.

Step 1: Scanning the Environment + Structural Details

SkyMesh deployed a high-fidelity scanning workflow designed for delicate, real-world heritage sites:

Ruins Scan:

Used LiDAR and high-resolution photogrammetry to capture the entire ancient site—including weathered stone, carvings, and terrain topology Captured material texture, erosion patterns, and fine structural cracks for photorealism Delivered a clean, quad-based mesh + reference photography for modeling, lighting, and simulation

Surrounding Area + Lighting Conditions:

Scanned the surrounding terrain and nearby features to provide accurate occlusion and depth for matte painting Captured HDRIs at multiple times of day to preserve natural lighting for integration across multiple sequences Generated camera-aligned point clouds for matchmove and set extensions

Step 2: Simulation, Layout & Action Integration

The scan data was processed in RealityCapture and Maya, then brought into Houdini for procedural destruction, debris simulation, and character interaction. Camera moves were driven by real-world topology, with lighting matched using HDRIs and baked ambient occlusion. The entire chase unfolded inside the digital twin—realistic, yet fully controllable.

Results & Impact

Metric	Traditional Workflow	With SkyMesh 3D
On-site filming time	10+ days	2 days (scan only)
Set recreation cost	~$150K	$0
Lighting realism	Approximate	Native match
Environmental authenticity	Partial	Fully preserved

Key Takeaways

- Rapid scan deployment saved the scene from being cut or replaced
- Actor's likeness, costume detail, and physical accuracy were preserved
- The scan pipeline shortened modeling and rigging time by more than 60%
- The result: a seamless CG shot that held up under slow-motion scrutiny

Wrapping Up

In visual effects, realism matters—but so does efficiency. 3D scanning empowers VFX artists to work from real-world truth, speeding up production while elevating quality. Whether it's a scanned prop, a full-body double, or a city street, the message is clear: if it can be captured, it can be controlled.

SkyMesh 3D helps studios do more with less—by delivering the detail, accuracy, and flexibility VFX teams need to bring imagination to life.
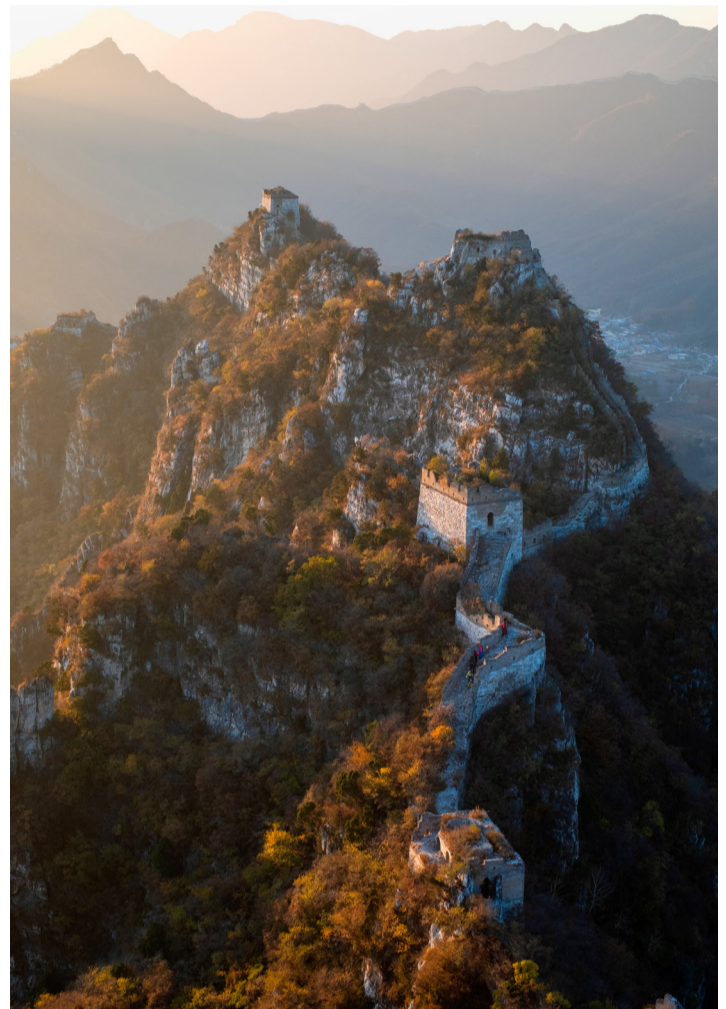
THANK YOU

Thank you for exploring the future of visual effects with us. If you're here, it means you care about the tools that shape storytelling—and the technology that's pushing creativity forward. At SkyMesh 3D, we believe 3D scanning is more than a technical process; it's the beginning of a smarter, faster, and more immersive way to make magic on screen.

If this book sparked new ideas, we'd love to invite you to join our mission. Back our Kickstarter campaign and help us build the next generation of reality capture services tailored for the world of VFX. Your support fuels the scanners, software, and innovations that will help artists, studios, and indie creators do their best work.
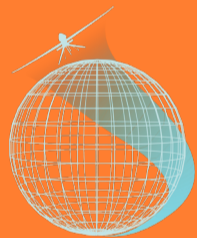
We have a lot more to share about the possibilities of SkyMesh

Stay connected with us at MilestoneDigital. io/SkyMesh for updates, behind-the-scenes footage, case studies, and new content from the field. The future of visual effects is grounded in real-world data—and with your help, we're ready to capture it.

With deep gratitude,
– The SkyMesh 3D Team

SKYMESH 3D

Milestone Digital sets the standard in creating digital assets. Learn more on our website at:

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