



IT IS INNOVATION

NOVEMBER/DECEMBER 2021

**SIERRA NEVADA
CORPORATION'S
CHAIRWOMAN,
PRESIDENT AND
OWNER**

Eren Ozmen

**Making Commerce in Space a Reality
Space Tech Comes to CES 2022**

THE 2020/2021 CT HALL OF FAME

CES 2022 PREVIEW

Consumer
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The Energy of Live Events



“
Technology helped many of us stay employed and productive during the difficult Covid months, but it also taught us about our own humanity. We discovered that as humans, we really do need each other.
”

A few weeks ago, I had an amazing experience at the Élysée Palace, France’s equivalent of the White House. In a seven-minute speech, French President Emmanuel Macron spoke movingly about my role in supporting France’s innovation ecosystem and bestowed me with the Légion d’Honneur, pinning a medal on my suit jacket. It was one of the most humbling experiences of my lifetime, and prompted some reflection on how important human interaction is to our experience of the world.

Technology can play a powerful role in keeping us connected. From immersive home theater to AR/VR, to connecting far-flung family and friends for reunions and religious services, to capturing the best authors and educators in their own voices, technology has revolutionized what it means to engage with people and experience content. Technology has provided solutions to global challenges in healthcare, education, communication, mobility, climate change and clean water — and is poised to do even more.

But one lesson from this horrible pandemic is that technology — as important and powerful as it can be — can’t replace face-to-face human interaction. Technology helped many of us stay employed and productive during the difficult Covid months, but it also taught us about our own humanity. We discovered that as humans, we really do need each other.

Talking to business executives, I hear the same frustrations about a loss of communication and culture in a virtual-only environment. Relationships suffer. Vital information is lost. Employees are less engaged and more stressed out, overworked and disconnected. Customers are frustrated. Layer on the mental stress of isolation and endless video calls, not to mention ever-expanding supply chain issues, and only the most Pollyannish optimist would describe the past 20 months as anything but challenging.

And yet, thanks to vaccines and a better understanding of effective health protocols, the world is beginning to open back up. CTA recently hosted live, face-to-face business events in Amsterdam, New York, Washington, DC and Paris. One word describes all of these events — joyful! The happiness our guests shared as they saw old friends and met new people was real and palpable. Each event was different but attendees at each of them shared an enthusiasm for coming together with people passionate about innovation and technology.

That enthusiasm was evident in my meeting with President Macron as well. While his words



Emmanuel Macron and Gary Shapiro.

may have been scripted, President Macron’s personal belief in CES and its impact on France and hundreds of French companies shone through. Even in a tough moment in U.S.-France relations, President Macron took the time to recognize the value of CES as a driving force for innovation — an incredible testament to the event and the work of the thousands of people who make it possible each year.

On a personal level, I still recall the strength of President Macron’s words, the sincerity of his gratitude, the presence of the French friends in the room who nominated me and the overall ambiance of the historic location. No video call could have conveyed any of those things.

In the same way, no technology can fully replace the magic of the CES show floor. I so look forward to the five-sense experience of CES. It’s about the relationships created and strengthened. It’s about the joy of discovery and serendipity of chance meetings. It’s about sharing a meal or a drink with colleagues. And it’s about growing business by getting there first, discovering new opportunities and forging and strengthening ties with partners, investors, customers and media.

I look forward to sharing those experiences with you in Las Vegas in January.

Have a safe, happy, healthy and grateful holiday season.

Gary Shapiro,
President and CEO

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Leaders with a Vision

The hustle of the holiday season means CES 2022 is coming soon with its power to inspire new ideas. We are also inspired by the standouts in our industry. Created in 2000, the CT Hall of Fame will grow to 279 members with the addition of 12 new honorees this year. The classes of 2020 and 2021 are being inducted together since the dinner was postponed last year due to the pandemic. At the dinner, to be held in New York on November 11 at the Metropolitan Pavilion, we will recognize exceptional industry leaders including our Innovation Entrepreneur Award inductees and the first recipient of the new John and Jane Shalam award.

Eren Ozmen also has an inspiring, entrepreneurial story. She has transformed from a student with no financial resources to billionaire co-owner of Sierra Nevada Corporation (SNC). She is chairwoman, president and owner of SNC, the global aerospace and national security leader that has grown to become the top woman-owned U.S. government contractor. Involved in all aspects of SNC's business management, Eren has overseen 20 strategic acquisitions. SNC is also a first time CES exhibitor and they are bringing their latest space tech to the show floor. Read our exclusive profile to learn more.

This packed pre-CES issue aims to kindle your curiosity to see the amazing technology on the show floor. We have in-depth stories on the latest in all-electric trucking, the enormous

potential for eSports, what's coming with the metaverse and some groundbreaking work being done in fashion tech. We also look at the big presence European companies will have at CES 2022 including such special areas as Business France, GREAT Britain and Northern Ireland Pavilion C/O Tradefair, Holland Tech Square, the Italian Trade Agency and SwissNext.

We also take a look at NFTs that will be part of the new digital assets exhibit and conference at C Space. You won't want to miss Atomic Form, a New York software and hardware NFT art market solutions company, that will be showcasing its 27-inch 4K LCD Atomic Form Wave that displays NFTs in a customizable way and lets customers control how their crypto art is displayed. Its Atomic Form Photon enables users to display their NFTs on any screen.

With the holidays right around the corner, see the results from CTA's 28th Annual Consumer Technology Holiday Purchase Patterns report. We also feature CTA's 5th Annual Future of Work study that reveals three key trends that will impact the workplace going forward.

Happy holidays to all and see you in Las Vegas where we are motivated by a belief in a better future. We want to hear from you, please send comments to: cstevens@CTA.tech.

Cindy Loffler Stevens
Cindy Loffler Stevens,
Editor-in-Chief



INNOVATOR

Sierra Nevada Corporation's Chairwoman, President and Owner **Eren Ozmen**

How her cutting-edge technology and quiet competence is making commerce in space a reality

Eren Ozmen has one of the most inspiring, entrepreneurial stories ever. She has transformed from a student with no financial resources to billionaire co-owner of Sierra Nevada Corporation (SNC). She is chairwoman, president and owner of SNC, the global aerospace and national security leader based in Sparks, NV. As sole owners of SNC since 1994, Eren and her husband, Fatih Ozmen, who is SNC's CEO, are the driving force behind SNC's incredible journey from small high-tech startup to multi-billion-dollar global leader in space, aviation, national security and defense.

Turkish immigrants, the Ozmens came to America separately for graduate school in the 1980s. They acquired SNC, the small defense company where they both worked, in 1994 when the company had only 20 employees. The company grew to become the top woman-owned U.S. government contractor. Involved in all aspects of SNC's business management, Eren has overseen 20 strategic acquisitions.

The Ozmens are among a wave of wealthy entrepreneurs involved in space endeavors. From Elon Musk's SpaceX, Richard Branson's Virgin Galactic, Larry Pages' Planetary Resources, Mark Cuban's Relativity Space to Jeff Bezos' Blue Origin, with whom Sierra Space, SNC subsidiary, is partnering.

In April 2021, they launched Sierra Space, an independent commercial space company. Its "space-as-a-service" business model will leverage cutting-edge technologies, such as Dream Chaser® spaceplanes and expandable LIFE™ habitats. The space economy is forecast to soar to \$1.4 trillion by 2030. SNC has participated in over 500 missions to space, including 14 missions to Mars.

Eren's vision for making a positive impact extends beyond the walls of her companies. Through the Ozmen Foundation, she supports a variety of causes including STEM initiatives and cancer-related medical research. She also founded the Ozmen Center for Entrepreneurship and the Ozmen Institute for Global Studies at her alma mater, the University of Nevada, Reno (UNR). She also received an honorary doctorate degree from UNR in 2016. In June 2021, Eren was included in the inaugural Forbes "50 Over 50" list among many other honors she and Fatih have earned. She recently discussed space tech with *i3* including plans for CES 2022.

Q You have an incredible success story. Can you talk about your journey and lessons learned?

A I am incredibly grateful to be living my own American Dream with my husband and business partner, Fatih. I came to America from Turkey on my own with only a backpack when I was 22 to pursue my MBA. I had no financial resources and barely spoke English. I worked part time and earned a graduate assistantship to pay for my tuition.

Fatih finished graduate school in the States and started as an engineering intern

at Sierra Nevada Corporation (SNC), landing a permanent job as an engineer. We became good friends and later we got married. I joined SNC as a consultant to automate SNC's financial system when SNC was struggling. As a result of my financial advice, I was offered a role as the company's first controller.

In 1994, Fatih and I had the opportunity to acquire SNC. It was a small company with only a handful of employees. With my business acumen and Fatih's engineering know-how, we won our first major contract and then the next, slowly earning the trust of our



customers by focusing on agility, affordability and performance. Once we strengthened the company's finances, we started taking calculated risks that paid off, pushing the envelope with cutting-edge technologies and building an extremely talented workforce.

We've grown SNC through persistence and strategic acquisitions. Our growth strategy is to identify opportunities with a multiplier effect, where 1 + 1 = 11. We're proud to have created a company culture rooted in innovation. SNC grew from a modest small business with 20 employees into an award-winning, multi-billion-dollar global leader in aerospace and national security. We are proud to employ more than 5,000 people in 20 states and three countries.

The growth of SNC is a personal story for Fatih and me, as much as a source of professional pride. When we serve our military or NASA, we are very cognizant that this is our way of giving back to the country that gave us our start.

Q Can you tell us about Dream Chaser and the LIFE Habitat?

A The Dream Chaser® spacecraft is the world's only commercial spaceplane. It's a true game changer, combining green technology and the ability to land on a commercial runway.

Starting at the end of 2022, we are contracted to fly seven cargo missions for NASA to resupply the International Space Station (ISS). Our return will mark the first runway landing of a commercial spaceplane since the last NASA shuttle mission, which ended in 2011. Its cutting-edge design

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This is our first year at CES and we are eager to showcase our vision to build and support a bustling low-Earth orbit economy.
 ”

allows every spaceplane to be reused up to 15 times. In a few short years, we envision a fleet of Dream Chaser spaceplanes flying cargo and passengers to space and landing on runways across the globe.

Our LIFE™ Habitat is made of an extremely durable, Kevlar-like material that expands on-orbit to become a large, three-story structure where people can live and work. The LIFE habitat launches off a conventional rocket and can be positioned in low-Earth orbit, on or orbiting the moon, or even on Mars.

Extremely versatile, LIFE habitats can be used for space manufacturing, microgravity research, space tourism or any other commercial activity. The habitats also have separate living and exercise quarters — we’ve even developed an Astro Garden to provide occupants with fresh food. Vegetables are growing right now on the ISS because of our advanced plant growth system! We truly believe the LIFE habitat will prove critical to getting more people living comfortably and innovating in space.

Q What sets SNC apart from its competitors?

A SNC primarily serves the national security and defense interests of the U.S. We provide critical life-saving technology like our Enhanced Vision System (EVS) that enables pilots to see through dust and fog, and IED (improvised explosive device) jammers that keep our warfighters safe.

We launched Sierra Space from the space capabilities within SNC earlier this year to build on these accomplishments in the rapidly expanding commercial space market. While the space market is highly attractive, there are very high barriers to entry. We believe that Sierra Space has the right team, the capabilities that the market needs, and a

Q What are the most disruptive tech trends impacting the space industry?

A One of the biggest trends affecting the space industry is a new form of public-private partnership. NASA is looking to companies like Sierra Space to expand its space initiatives, including support for the ISS. We are also seeing innovative strategic partnerships that bring companies together to accelerate growth in space. Sierra Space and Blue Origin are working together to develop Orbital Reef, a commercial space station that will transform human space travel and open access to new markets. This is a perfect example of the power that comes from bringing together companies with complementary capabilities and an aligned vision.

proven 30+ year track record with existing trusted partnerships to meet these demands much faster than new entrants.

Q Can you share more about Orbital Reef and your partnership with Jeff Bezos’ Blue Origin?

A Sierra Space and Blue Origin are principal partners on Orbital Reef and we are very excited to join forces with Jeff Bezos to bring this visionary commercial space station to life. By the end of this decade, Orbital Reef will be the premier space station in low-Earth orbit for commerce, research and tourism. Think of it as a space business park. This orbital destination will be commercially developed, owned and operated. It will bring space within reach for business and travel, creating a new ecosystem.

Our Dream Chaser will provide the transportation, and our LIFE modules will provide the destination on Orbital Reef. Sierra Space will also provide a node that will be used for a variety of exploration and logistics functions on the station, including docking ports to connect visiting vehicles and spacecraft. These elements will make the Orbital Reef accessible and flexible so more people, science and businesses can benefit. Sierra Space and Blue Origin are committed to a long-term vision and equal partnership for low-Earth orbit beyond the Orbital Reef.

Q SNC has a reputation for disruptive innovation. What developments are you most excited about?

A Fatih and I have always focused on how we can make a global impact. Technological innovations we make today have lasting impacts on generations to come. We have three major corporations that are fueling breakthrough technologies that will impact humanity.

As an independent commercial space company, Sierra Space is building a vibrant

LEO (low-Earth orbit) space ecosystem accessible to all by providing transportation, destinations and space applications.

Orbital Reef, for example, will be humanity’s footprint in low-Earth orbit as we reach beyond the surface of the planet.

SNC works with our DOD customers to transform the way we protect the freedom of our people using advanced technologies. For example, SNC TRAX® software is a military communications system that connects otherwise incompatible systems and networks. And our SKL enables safe and secure communications for those who operate in some of the most dangerous situations in the field.

With SNC’s subsidiary Deutsche Aircraft, we are paving the way toward zero emissions flights within the next 10-15 years, well ahead of international guidelines. The 328eco™ aircraft combines today’s advanced technology with Dornier’s proven heritage, and in partnership with the German government, will bring a more environmentally friendly aircraft to the market for true sustainable global impact. ■

Q What are your plans for CES?

A We are thrilled to come to CES to display a full-scale Dream Chaser model. This is our first year at CES and we are eager to showcase our vision to build and support a bustling low-Earth orbit economy. We think our Dream Chaser and other space technology will fit right in alongside the other breakthrough technology and global innovators at CES. Fatih and I are hopeful you will join us as we share more about our story and future plans for space as part of the *Great Minds* fireside chat series.

Blickfeld introduces new long-range LiDAR. ▼



Germany Takes to the Roads

Germany was part of the top 10 of Global Innovation Index 2021 rankings. Returning German exhibitor **Cinema**, under a new partnership with **Dolby Atmos**, looks to make traffic jams a little less painful with a full, immersive sound experience with in-car entertainment systems. Munich-based **Blickfeld** will be showing **LiDAR** technology for autonomous vehicles and **Internet of Things (IoT)** applications, while the **3D data** produced by the **LiDAR** still preserves individual privacy. And while you are planning the next road trip on the information superhighway, you may want to check out **Devolò's** smart home products for faster, secure internet access. A new **Devolò** product uses the **European ITU G.hn** standard for powerline networking, while another is a hybrid device that uses both powerline networking and mesh Wi-Fi.

INTERNATIONAL FOCUS

EUROPE



The Dutch Make Their Way to CES

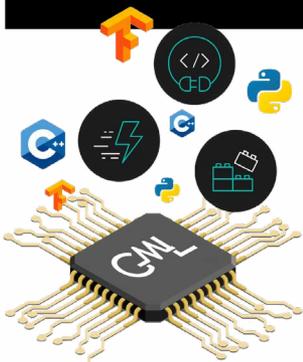
Seventy startups from the Netherlands are slated to appear in Eureka Park's Holland Tech Square at CES 2022. Dutch digital health companies run the gamut: **Light Tree Ventures** will show affordable options for companies to get light therapy to market for everything from pain and eczema relief for people, to faster healing for pets after surgery. **VRelax** is a virtual reality app designed to help manage mild stress to pain management (also at CES Unveiled Amsterdam). A Dutch CES Innovation Honoree includes **Videowindow**, a smart city solution that is a transparent video screen that produces dynamic glare control with heat absorption. **RanMarine** specializes in industrial autonomous surface vessels (ASV's) that will clean waterways from trash and other debris from worldwide waterways. And if you need to drive somewhere while producing little energy, **Lightyear** is the company behind solar car designs.

ON THE MAP AT CES 2022

With the recent change in travel policy, Europe will have a big presence at CES 2022 including such special areas as **Business France**, **GREAT Britain and Northern Ireland Pavilion C/O Tradefair**, **Holland Tech Square**, **SwissTech Pavilion** and the **Italian Trade Agency**, though you will also find exhibitors with European connections throughout the show floor. **Artificial Intelligence (AI)**, **digital health**, and **mobility** are just some of the categories highlighted by European CES exhibitors. All types of technologies and products will be on display. British company **Ultraleap** aims to put the world at your fingertips with haptic technology, to connect naturally in 3D — no special controllers required. Swiss company **CORE's** connected monitor lets you continuously track your body's temperature, to improve athletic performance. And stay focused with the **Origo Steering Wheel**, designed by a Finnish-based consortium to decrease driver distraction.



CES 2022 The Netherlands marks a record with 14 Innovation Award honorees at CES 2022 and France has 16 Innovation Award honorees, the most of any European country.



France at CES 2022

France has been one of the top exhibiting countries at CES in recent years, and CES 2022 is no exception. Previewed in CES Unveiled Paris in October, **Inhalio** is transforming our environment through scent for homes, businesses and even cars with multi-sensory, mood-mapped experiences with their digital dry-air diffusion. There are only nine companies making chips in Europe, and **GrAI Matter Labs** will be at CES in Las Vegas, releasing an AI processor that is 20 times more efficient than others on the market by reducing energy consumption. The French company is also developing an AI curriculum for educators and students. French startup **Lexilife** is returning to CES, with a new version of their connected lamp that uses both pulsed and modulated light to make life easier for those with dyslexia.

Clockwise from top left: Blickfeld courtesy of Business Wire; Peter Hermes Furian/Shutterstock; courtesy Lightyear; courtesy GrAI Matter Labs.

C4 TRENDS

Fashion Tech for a New Era

Hyperconnected consumers expect to interact with retailers through multiple channels simultaneously.

Technology is changing the way consumers shop for fashion through social media apps, retail shops, digital dressing rooms and augmented reality. Consumers now expect an integrated and consistent digital experience across platforms when they go online to browse, research and buy goods.

Fashion Capitals Go Digital

While couture fashion hubs have long been in New York, Paris, London and Milan — Instagram and TikTok are now setting the fashion agenda, with Instagram becoming a store window display and TikTok furthering the conversation. Technology has disrupted the traditional fashion power structure centered around Fashion Week. Instead of limiting the introductions to elite editors, buyers and stylists — many are taking their fashions directly to new pipelines making the merchandise in their runway shows readily shoppable.

Influencers can buy the collections online and in stores the same day they were shown on the runway instead of the usual six-month lag. Social media also is democratizing fashion by enabling younger and smaller designers to directly connect with followers and new audiences.

“Smart” Wardrobes

It's more than smart watches or what you wear on your wrist. Technology in fashion is becoming more pervasive. Digitally-enabled fabrics, with IoT capabilities are expected to become big business as new multi-material fibers reveal new applications.

Gaming and The Direct-To-Avatar Model

The fashion world was recently abuzz with news that Balenciaga and Fortnite teamed-up for a multi-tier partnership. Included are Balenciaga outfits for Fortnite players, a physical Balenciaga collection inspired by the game's Retail Row, a virtual Balenciaga store and billboards featuring gamers, and behind-the-scenes videos on how it came together. It's Fortnite's first luxury fashion collaboration and a sign that fashion and the metaverse are getting cozier. Prior partnerships with the same cross-category linkup include Louis Vuitton x League of Legends in 2019 and Gucci x Roblox earlier this year.

◆ The Fashion Banshee Outfit, one of four characters in Fortnite's "Balenciaga Fit Set."

INNOVATION IN FABRIC

MIT and the Fashion Institute of Technology (FIT), joined forces in 2017 to build a bridge between design and engineering, and develop sustainable fabrics.

MIT and FIT also reached out to AFFOA (Advanced Functional Fabrics of America), a Cambridge, Massachusetts-based nonprofit public-private partnership. AFFOA and its membership ecosystem are helping to develop transformative textile-based products that meet the needs of defense, commercial and consumer markets.

The MIT, FIT AFFOA collaboration is yielding interesting results, as fashion and tech come together. Here is the latest news according to releases from the following groups.

Team Natural Futurism, developed a biodegradable lifestyle shoe using natural material alternatives, including bacterial cellulose and mycelium, and advanced fiber concepts to avoid use of chemical dyes.

Team Peacock, prototyped athletic apparel with color-changing material to highlight an athlete's movement and quickly analyze motion through an app.

Team Ecollab, designed apparel and footwear using PE (polyethylene) and color changing material that is multifaceted and environmentally conscious.

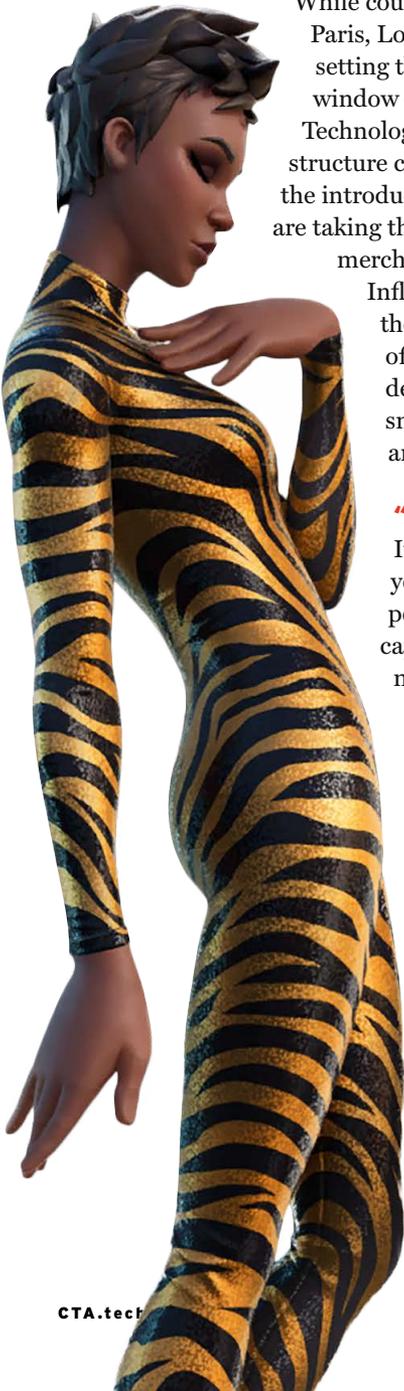
Team Laboratory 56, created footwear to enhance longevity of product and reduce waste using PE, while connecting with the community through a recycling app program.

This is big news because 50% of Fortnite's 400 million global players are spending their time in Fortnite, allowing them to create their own virtual worlds. Immersive, customizable worlds are engaging and serving as creative outlets for large audiences that fashion brands are looking to target.

As the worlds of fashion, fabric and technology intersect, new collaborations are driving innovation. ■



Tech fashion and the metaverse merge at CES 2022.



A TECH TO WATCH

Future of the Internet

The Metaverse

You've probably heard of augmented reality (AR), virtual reality (VR), mixed reality (MR), and now there is the metaverse

A term first coined in science fiction, the metaverse refers to immersive, always-on, virtual environments created by billions of people interacting with it and each other. These are shared virtual worlds where avatars—digital versions of us—play, socialize and even work together.

The term “metaverse” first appeared in Neal Stephenson’s 1992 sci-fi novel *Snow Crash* where it referred to a 3D virtual world inhabited by avatars of real people. Considered the successor of the current internet, its characteristics include unprecedented interoperability — users can take their avatars and goods from one place in the metaverse to another. Anywhere you go, you can sit down, and through monitors, bring that world with you wherever you want.

Instead of just calling or texting someone on the phone, they can teleport in, and see the context that you have, then afterwards teleport back to where they were. The metaverse provides open access to all, a sense of presence and perhaps most importantly, a fully functioning economy. This economy allows the transfer of digital assets such as non-fungible tokens (NFTs), where creators get paid in cryptocurrency.

Real-Time and Live

Pre-scheduled and self-contained events happen in the metaverse but will be collective rather than singular incidences where many users can

interact concurrently in a shared experience. The metaverse spans both the digital and physical worlds, as well as private and public networks. You can buy virtual products or receive them as perks. It will not replace the internet, but instead build upon and transform it, bringing the physical and digital worlds together.

The metaverse places everyone inside a virtual ‘3D’ version of the internet.

Facebook describes it this way: “The metaverse is a set of virtual spaces where you can create and explore with other people who aren’t in the same physical space as you.” At this writing, Facebook is about to open Connect 2021 to hear CEO Mark Zuckerberg talk about bringing Meta to life. Connect 2021 will spotlight developers, creators, enthusiasts and gamers building the future of AR/VR together. Speakers will explore how AR/VR will lead to the next evolution in online social experiences.

The metaverse places everyone inside a virtual ‘3D’ version of the internet. Put another way we will constantly be within the internet, rather than have access to it. Facebook says the company will strive to build an interconnected set of experiences — a world known as the metaverse.



The metaverse promises to host more information than social networks do today. Potentially, you could spend eight-plus hours in the metaverse working in virtual spaces creating and exploring with people who aren’t in the same physical space as you. You can interact with friends, play, work, learn, game and shop. As remote work plays a bigger part of the post pandemic future, remote employees will share the same opportunities as the people who are physically onsite.

Many of the immersive experiences of the metaverse will only be fully realized in the next 10-15 years. Yet it would be a mistake to think of VR headsets as the metaverse, just as you don’t think of smartphones as the mobile internet. Similarly, games will be part of the metaverse, but are not the metaverse itself.

The concept is expected to yield huge financial opportunities for companies stemming from environments like social media, video games, E-commerce and blockchain. ■

PIPE LINE

The Next Internet

The technologies to create the metaverse are now emerging.



During CTA's Fall Technology and Standards Forum in September, there was a fascinating panel discussion on the Future of Content where Bart Spriester, Comcast's vice president and general manager of Content & Streaming Provider Solutions, introduced the metaverse as "the next internet." It's a bold but frequent description that gets at the essence of the expected shift from looking at social media in today's internet to interacting with others in boundaryless communities in the metaverse. Immersion and interaction are key to its success, and the building blocks for those attributes are virtual reality (VR) and gaming technology.

CTA's market research suggests that these ingredient technologies are on a hot streak. Shipments of mixed or extended (XR) eyewear (augmented reality (AR) and VR headsets combined) to the U.S. will more than quadruple from 2021 to 2025. That's a 46% compound annual growth rate (CAGR). CTA also forecasts that consumer spending on gaming software will grow from \$47.6 billion in 2021 to \$59 billion in 2025.

Immersive Tech

Consumers' willingness to spend on gaming is a good sign for companies investing in the metaverse, but of greater interest for building the metaverse is the technology behind gaming. During the same Future of Content panel, Kaki Navarre, Disney's vice president of product management and media technology, described the interactive short "Baymax Dreams of Fred's Glitch" that debuted at the Virtual Sundance Festival. The interactive experience is unique in being completely driven by user interaction with the story — no linear story here — and being rendered in real time using Nvidia's GeForce Now cloud gaming service.

Even though the technologies to create the metaverse are developing, the Future

of Content panelists agreed on one thing we do not yet have. Widespread adoption of these interactive immersive experiences that we liken to the metaverse will require standards all along the supply chain. Great content is expensive to create. Game engines, like Unreal and Unity, are an enabling technology that lower the barrier to content creation, but standards are still needed for exchange, distribution and rendering on consumer devices.

That last step, rendering on consumer devices, is particularly challenging. VR headsets are improving by leaps and bounds, but there are still tradeoffs being made between image quality, device size and complexity. History says image quality will improve rapidly. Even as it does, content creators and distributors cannot expect that everyone will have a VR setup at home. The best content companies will have experiences that can be consumed on smartphones and TVs or with a full VR setup and allow users in either format to interact at the full quality their devices allow.

Standards Make it Happen

To achieve a metaverse that is open, like the internet, requires standards for how virtual worlds and avatars are going to

CTA has been developing standards to support the future of content through its XR Committee and the WAVE Project.

interact. Imagine "meeting" a group of friends at a VR concert and getting the full experience, including shopping for the band's merchandise. It's easy to see that the protocols behind that experience require exchanging information about where you and your friends' avatars are in real time and merging that with the live concert in much the same way Zoom merges everyone's audio and video on a conference call.

CTA has been developing standards to support the future of content through its [XR Committee](#) and the [WAVE Project](#) which aims to improve how internet-delivered commercial video is handled on devices and to make it easier for content creators to distribute video to those devices. People with ideas of how best to standardize the metaverse are encouraged to get involved at [standards.CTA.tech](#). ■

JUST KEEP TRU

There's a bright future for all-electric in trucking

Like their counterparts in the automotive arena, truck makers are working furiously to make their vehicles electrified, and have already begun deployments commercially as well as in market tests. But conversions will take time because the underlying technologies are still evolving.

By **Robert E. Calem**



JCKIN'



AN ELECTRICAL LOAD MOVES TRUCKING FORWARD

“We are on the verge of a paradigm shift in the transport industry,” says Lars Stenqvist, CTO and member of the Group Executive Board at Gothenburg, Sweden-based Volvo Group, which makes trucks, buses and construction equipment. One of the biggest trends is the move to “fossil free” vehicles, he says, declaring this transformation will be completed worldwide by 2050. That may seem like a long time away but because Volvo Group’s customers keep vehicles an average of 10 years, “that means everything we deliver from 2040 onwards must be fossil free in all kinds of applications,” he adds.

One way to accomplish the transition is to use traditional internal combustion engines (ICE) powered by synthetic diesel, biogas or hydrogen, which Volvo Group has already introduced.

Although he foresees “no end date” for ICE in heavy commercial vehicles, Stenqvist says, the company believes there will not be sufficient biofuel in the world to support all demand for road transportation. “We have come to the conclusion that most of our vehicles by then will be electric,” he says. “They will be battery electric (BEV) and fuel cell electric (FCEV).” Other manufacturers in the heavy commercial vehicle space are getting behind either BEV or FCEV, but Volvo Group is unique in that it’s backing both, “and we think that the sweet spots for these technologies are a little bit different,” he asserts.

BEV technology is best for city applications such as garbage trucks and local or regional delivery vehicles that return to the same garage where they can be charged overnight. By comparison, FCEV tech — or a hydrogen-powered ICE — is ideal for tractor-trailer trucks that travel long distances nationwide on different routes and variable schedules, and that handle heavier payloads, offer greater range and are more easily refueled.

These distinctions are not absolute, Stenqvist observes. For example, depending on their country or region of operation and its available infrastructure, some customers might opt for a fuel-cell powered city vehicle rather than a battery-electric version. He says, BEV powertrains are more mature than FCEV equivalents, with the latter expected to be better developed by the second half of this decade.

“The trucking and commercial side of electrification is incredibly exciting because the economics for end customers are very positive given the fuel savings and from the environmental aspect also,” says Tal Sholklapper, CEO and co-founder of Voltaiq Inc., a Berkeley, CA-based “enterprise battery intelligence” (EBI) software company that applies a big data analytics approach to battery product development. Its customers include Ford, GM, Stellantis, Mercedes-Benz Research and Development of North America (MBRDNA) and Proterra, which provides battery and electric drivetrain technologies for BEV school buses (Thomas), coach buses (Van Hool), delivery trucks (Volta) and excavators (Komatsu).

“Budgets are shifting towards electrification and EVs pretty broadly,” and commercial vehicles in particular “prove the larger scale economics around EVs” by virtue of extensive utilization each day, Sholklapper says. The battery pack will contribute most to the residual value of an EV, “and that’s where analytics are key.”

It's important to know the state of the battery cell when it's installed but also "to continue to ascertain its health over time, both for early service reasons and ensuring reliability and safety, but also to underlie those economics and residual value for those products," he says.

Voltaiq's cloud-based EBI software platform captures data about each battery from the beginning of its design through its operating life in a vehicle. The company does not do this analysis itself, but rather, "we work directly with [vehicle manufacturers] and their supply chain and provide them with this capability," Sholkapper says.

RIPE FOR INNOVATION

Fundamentally, an electric vehicle is one that has replaced the conventional powertrain [based on an ICE] with one that's using electric motors to turn the wheels. But what generates that electricity? You can either have a bank of batteries that you recharge with electricity that's generated elsewhere, or you can actually generate the electricity on the vehicle using a fuel cell," says Thomas Stephenson, CEO and chairman of Pajarito Powder, LLC, an Albuquerque, NM-based company that supplies a proprietary catalyst used to make fuel cells.

Within a fuel cell, hydrogen stored in a tank is combined with oxygen from the air, and through a direct chemical reaction accelerated by a catalyst generates electricity and emits pure water out of the vehicle's exhaust pipe. Normally that catalyst contains a large amount of platinum, which makes fuel cells enormously expensive.

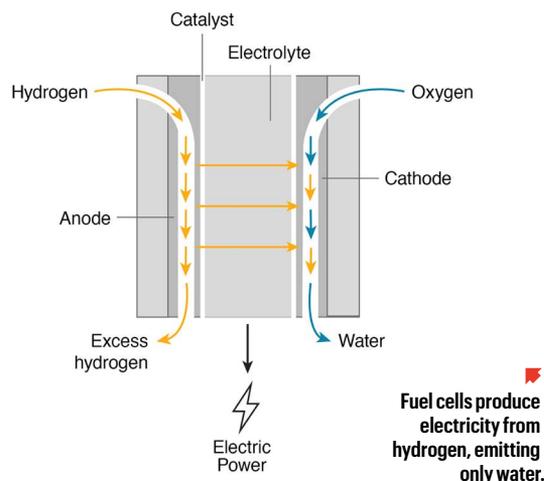
Pajarito Powder's innovation for the catalyst is a special spongelike, carbon-based material enabling 50% less platinum to generate more power per square centimeter of surface area, cutting the total cost of the fuel cell system by 20% and making FCEVs more financially feasible, Stephenson says.

"For big-rig trucking, the fuel cell is where the future is," declares R. "Ray" Wang, principal analyst and CEO of Constellation Research Inc., based in Palo Alto, CA. Both batteries and fuel cells need to be recharged — the latter in the sense that it requires refueling at a

"For big-rig trucking, the fuel cell is where the future is."

-Ray Wang,
Constellation Research Inc.

HOW HYDROGEN FUEL CELLS WORK



Hydrogen Fuel Cells

are seen as a potentially more viable zero-emission power system for long-haul freight in the future.

hydrogen station — and both can be swapped out for new ones, when necessary. However, "it's a question of who can get which power source to a distribution point faster," Wang says. Tesla has the capacity to produce battery packs and swap them in its Tesla Semi within 15 minutes, but FCEV truck makers like Volvo "will get there with fuel cells," he predicts. That will lead to a race between the two technologies but "fuel cells don't degrade" like batteries do and "fuel cells in the long run could actually cost four times less than lithium-ion batteries," he adds.

The remaining challenge for fuel cells is to make them more efficient from start to finish, Wang says. "Only 25% to 30% of the energy [from the source hydrogen] makes it to the wheel of a fuel cell car," versus 70% to 80% of the energy from a battery pack in a BEV, he says.

Wang highlights BYD, a Chinese company with a manufacturing facility in Lancaster, CA. BYD is the world's largest producer of electric vehicles in the heavy industry BEV space. "They have a viable model, they have a viable manufacturing capability and they're looking at a global footprint," adds Wang.

In August, at the Advanced Clean Technology (ACT) Expo in Long Beach, CA., BYD unveiled two new BEV heavy duty truck tractors — the third-generation 8TT and 6F — offering up to 200 miles on a charge. The company says it is the leader in BEV truck deployments, with more than 8,000 trucks in service worldwide, including more than 200 in the U.S.

BYD, Tesla and Volvo Group thus exemplify the contest between fuel cells and battery packs in heavy duty trucks, Wang indicates.

One of the greatest advantages of FCEV over BEV for heavy duty trucks is the fueling infrastructure, which resembles diesel's, says James Kast, a consultant at Toyota Motor North America's research and development facility in Gardena, CA. Toyota began exploring fuel cells with a first prototype in 2017, a second prototype in 2018, and then the company debuted a "platform" demonstration truck with Kenworth at CES 2019. Now, the platform is incorporated in six Kenworth "Ocean" trucks distributed to customers who are using them regularly, as part of a test program operating out of the ports of Los Angeles and Long Beach, CA. They can travel 300 miles on a tankful of hydrogen, carry 80,000 pounds when fully loaded, and refuel in less than 20 minutes (compared with six hours to recharge an equivalent BEV truck), Kast says. Refueling time is expected to improve further, he says.



Likewise, Hyundai Motor Co. has embarked on a 12-month demonstration program in southern California using two of its XCIENT FCEV tractor-trailer trucks for long-haul freight operations between regional warehouses. U.S. model XCIENT FCEV “Class 8” trucks offer a maximum driving range of 500 miles on a tankful of hydrogen. The program began in August as a joint operation with First Element Fuel, (FEF) California’s largest operator of hydrogen refueling stations and will use three of FEF’s stations in the region to replenish the trucks. Hyundai also announced a separate program for northern California that will begin in the second quarter of 2023 and involve 30 XCIENT trucks, to be “the largest deployment of Class 8 hydrogen-powered fuel cell trucks in the U.S.”

Toyota’s subsidiary Hino has developed a light duty FCEV truck based on the automaker’s second-generation fuel cell technology for cars. It improves on the fuel cell’s power density, efficiency, weight and “packaging” — putting it up front where the engine normally sits — to “target diesel parity,” Kast says.

To be sure, fuel cells don’t obviate batteries, says Pajarito Powder’s Stephenson. He says, it is standard for any FCEV to contain a combination of a fuel cell and a battery, which is used for acceleration and energy saving features such as regenerative braking.

“You have to have batteries and fuel cells to truly meet the breadth of mobility solutions that’s required in the electrified world we’re headed toward,” says Charlie Freese, executive director of the global hydrotech business at General Motors in Pontiac, MI. “Today things that are moved by internal combustion engines that are gasoline driven tend to be well suited to battery electric propulsion systems. The bigger vehicles that have long haul requirements or heavy payloads where diesels operate today, will start to be replaced by hydrogen fuel cells coupled with batteries for regenerative braking.”

A tractor-trailer truck would have to jettison 22% of its payload to accommodate the weight of a BEV powertrain, but only about 3% for a FCEV powertrain, Freese says, illustrating hydrogen’s efficiency over batteries in this application.

Yet not every tractor-trailer truck needs a fuel cell powertrain or could be a BEV, and the expected haul makes the difference. “If I’ve got a truck full of potato chips, I might be able to live with a [BEV]. But if I’m moving heavy payloads — steel or water — that’s where hydrogen is providing its

Electric Batteries
are best for local or regional delivery vehicles that return to the same garage where they can be charged overnight.

maximum benefit.” GM’s strategy has been to “develop a leadership position in both technologies and apply them where they fit,” he says. Besides trucks, GM is integrating fuel cell propulsion systems in locomotives and aerospace vehicles, Freese notes.

“When I think about the EV space, what I’m excited most about is that mid-market — where they’re doing the drops point-to-point between distribution centers to last-mile,” says Wang. He points to Workhorse Group Inc., based in Cincinnati, OH, and its C1000 BEV delivery van, which provides 100 miles of range, a 75 miles per hour top speed and 1,000 cubic feet of interior volume. “To me, it’s the delivery van of the future,” Wang says, “perfect for last-mile short hauls.”

“There’s a big future for all-electric in trucking, whether BEV or fuel cell, because fuel costs are so high,” says Celina Mikolajczak, vice president of manufacturing engineering at QuantumScape Corp., a San José, CA-based startup that is developing solid-state lithium-metal battery cells for EVs. “But you’ll see pretty quick adoption of batteries in delivery vehicles,” such as Amazon has begun to do in a test of BEV vans made by Rivian, she adds. ■



Learn how fuel cells can provide continuous power for long haul trucks at CES.



◆ Esports venue concept by Populous.

ESPORTS AIMING FOR THE SPOTLIGHT

By Gary Arlen

eSports – a \$700 million offshoot of the videogame industry – is rapidly passing through a growth spurt that involves corporate restructuring (including mergers and acquisitions), advertising experiments, deals for broadcast or streaming carriage, demographic shifts, collegiate eSport leagues, niche markets (such as Japanese seniors), security hacks, plus the impact of the pandemic.

Altogether, it's a familiar tech evolution story, with lots of twists.

CTA's new white paper, *eSports & Gaming Trends* concludes "the rise of eSports as a new form of media is here for the long term. Its strategic value to the game industry is well established." CTA's report reflects other groups' financial outlooks, such as a [Valuates Reports](#) assessment that eSports' global revenues will climb from about \$700 million in 2020 to \$1.86 billion in 2026, with a 15.1% CAGR during the next five years.

eSports remains an amorphous term that encompasses people who actively play videogames competitively as well as an increasing audience who watch the tournament players via YouTube, Twitch or other online sources. As the pandemic wanes, there will be a return to in-person matches, that take place in community and campus theaters and arenas.

Although role-playing games (RPG), fighting and first-person shooter (FPS), real-time strategy (RTS) and multiplayer online battle arena (MOBA) games dominate the eSports world, the category also includes an array of massively multiplayer online role-playing games (MMORPG) such as *Counter-Strike*, *League of Legends*, *Warcraft*, *Dota 2*, *Fortnight* and *Valorant*. Individuals and teams compete for thousands or millions of dollars in purses.

CTA's report categorizes three types of eSports followers:

- » **Core Gamers:** Gamers who play PC or console games for one or more hours per week.

- » **eSports Viewers:** Those who have watched professional eSports tournaments on TV or livestream in the past year.

- » **eSports Fans:** Those who watch professional eSports but also attend live events or have competed in a game tournament in the past year. eSports fans not only passively watch gameplay but are active participants in the eSports ecosystem.

About a third of the eSports audience is age 16- to 24-years old; 30% are in the 25- to 34-year-old age bracket, and 19% are 35- to 44-years old.

IMPROVING OUTLOOK AS PANDEMIC WANES

CTA's white paper, produced in collaboration with Interpret (an international market research firm), acknowledges that the pandemic created a set-back for live events, which restricted in-person gaming tournaments and shifted much of the competition to online events. Nonetheless, "fundamentals of the industry remain strong and the eSports viewer base continues to grow," CTA says. It cites Accenture's analysis that the gaming industry gained half a billion players during the last three years, noting that growth will continue to come via mobile platforms plus demographic factors, especially participation from women and non-white gamers. The report acknowledges during the pandemic, "esports viewers, like many consumers, have been forced to cut back on entertainment expenses" but it foresees a recovery due to the strength of the underlying videogames sector.

"Teams that have fared well and increased their value this year, such as FaZe Clan and 100 Thieves, succeeded because they evolved into broader entertainment brands, not just eSports pros," according to the report. It endorses "a focus on content creation in the gaming culture and fans' affinity for team stars." These factors generate stronger fan engagement and ultimately attract more sponsors.

The CTA analysis also foresees expansion in eSports. "While live competition remains at the heart of eSports, organized matches of recognized players and teams fill only a fraction of game-related viewing time," CTA says. "Shoulder or scripted content allows teams and publishers to grow audiences between official events, promote their brands and create new opportunities for sponsorship."



Private gaming pods concept by Populous.

INDUSTRY COLLABORATION

“The eSports industry is founded on collaboration with the tech industry,” explains Steven Hummel, manager of CTA Market Research. Citing “the massive growth” of eSports, Hummel envisions eSports’ role as a driver for diversity, inclusivity, and equal opportunities — what he calls “social good.”

Mike Lee, an eSports agent at United Talent Agency (UTA), says, “The definition of eSports has become very broad.” His agency team works on ways to showcase how players “can be a great fit with a brand.”

“Gaming is global, and social gaming platforms and audiences will only get larger as more people get access to interactive games and high-speed internet,” Lee predicts. “The game you play in the U.S. is the same game they play in China or Korea, but different regions gravitate towards different games. Mobile gaming is large in Asia and South America and console and PC gaming is popular in North America, Europe and eastern Asia.”

Lee believes that eSports audiences “will drive the future of the metaverse.”

“It’s an audience that has access to broadband internet, multiple smart devices, and is engaged and interacting with one another through platforms like Twitch, YouTube, Reddit and Twitter.”

Lee points out that viewership across Twitch and YouTube went up during the pandemic stay-at-home period, which increased the value of gamers. He says with traditional sports on hold, brands and

agencies shifted some of their marketing dollars towards eSports. “Gaming and eSports became a great relief during the pandemic and will continue to do so,” Lee says.

As for the near future, Lee says to reach the next level of success eSports will need “the support of a major broadcaster or streaming platform.” Specifically, he envisions media groups will buy the distribution rights and leverage marketing dollars to drive the growth of competitive gaming.

Comparing it to NBC’s alliance with the Olympics and Turner Broadcasting’s relationship with the NBA, Lee says that “a gaming publisher like Riot or Activision needs to find the right partner who will grow the competitive scene together by marketing the players and matches.”

Lee explains “Live entertainers who drive engagement and fandom through casual game play can be great partners for big brands. Sharing these stories with advertisers and brands will help build the next Jordan brand or OVO.”

Lee says, “Like traditional sports, advertisers are realizing how important it is to partner with key personalities and work together to create campaigns and products that speak to the talent’s community such as Under Armor’s partnership with NickMerces, Oakley with Scump, and Sweetgreen with Valkyrae. We’re now seeing more talent-led campaigns, and brands wanting to consult with talent more than ever before.” (“NICKMERCES” is the playing name of Nicholas Kolcheff, a 31-year old competitive Twitch and YouTube streamer signed with FaZe Clan.

DIVERSITY EVOLVING

The most prominent trend is the gaming community’s effort to recruit more female players to eSports leagues or support more female game developers, the CTA study explains. “Gender parity initiatives not only are a showcase of social justice but also make business sense.”

For example, CTA’s report cites the percentage of female eSports participants as about 43% to 44% in China and India this year compared to 21% in the U.S. (lower than the 28% in 2020). In Australia, the female share of eSports players is 19% this year (versus 24% last year).

“The eSports and gaming industries are at the forefront of driving social justice causes, especially on the topics of gender and racial diversity and inclusiveness,” the report says, citing initiatives from game publishers, teams, technology companies and NGOs (non-governmental organization) “to advance social justice causes and bring impactful changes to our society.”



ESPORTS AT CES 2022

The increasing vitality of eSports has a large role at CES 2022, which includes topics ranging from emerging business models to new rivalries as traditional sports and tech companies enter the market. Sessions will focus on free-to-play games, in-app purchases, advertising and subscription services as well as the impact of emerging technologies. Speakers will explore topics such as “Transmedia Storytelling in eSports: Creating Superfans,” which looks into IP development to make community a priority in franchise development.

Cxmmunity, a nonprofit group working to increase diversity in the esports and video game industries, is hosting a 16-team NBA 2K tournament for historically black colleges and universities in partnership with Michael B. Jordan’s Invesco QQQ Legacy Classic. Separately, the Central Intercollegiate Athletic Association, the nation’s oldest historically black athletic conference, and the National Junior College Athletic Association Esports have partnered to develop collegiate eSports and gaming eSports at their member institutions. They aim to develop relationships and recruiting pipelines.

eSports are also attracting older participants. The Matagi Snipers is Japan’s first professional eSports team with all its members over 66 years old. The team was established as a way to show the health benefits of esports for older adults, as well as to impress the grandkids. Twenty-one people applied to join the team, but only eight made the cut, according to *NHK*.

GROWING ROLE FOR MOBILE ESPORTS

CTA’s report cites mobile platforms as “an important area of expansion for core gaming IP thanks to titles like *Fortnite*, *PUBG Mobile*, *Free Fire*, and *Call of Duty Mobile*.”

“The growth potential for eSports on mobile is enormous, which is very hard for sponsors and investors to ignore,” the study explains. “The rise of mobile platforms like Skillz and games like *Among Us* has highlighted the importance of serving a ‘social’ or light gamer.”

DIGGING INTO THE DATA

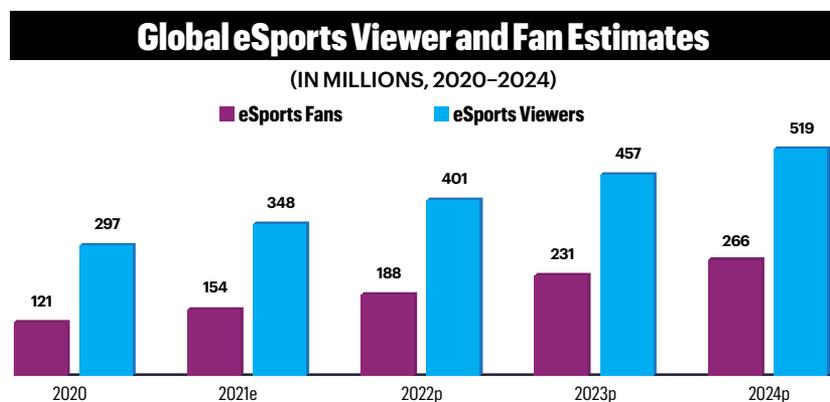
CTA’s white paper is filled with data points showing the foundations of eSports usage, such as:

- » 6.3 billion hours of eSports watched on Twitch in Q1 2021 compared to 3.1 billion a year earlier.
- » 12.5 million unique channels of streaming content on Twitch: more than double the year-earlier level
- » Average concurrent viewership also doubled from the previous year. At the end of March 2021, Twitch saw its viewership more than double from a year earlier and has achieved a significant increase in market share in the U.S.

BUILDING BROADCAST AND ADVERTISING CONNECTIONS

Although U.S. broadcast and cable programmers initially shied away from carrying eSports content (for example, ESPN closed its eSports operation last year), pandemic-fueled interest has generated rethinking. For example: media giant E.W.Scripps Co. invested \$10 million a few months ago (part of a \$35 million investment round) in Misfits Gaming Group, a global eSports operator. The deal gives Scripps an opportunity to distribute MGG’s content through its linear and over-the-top television platforms.

BBC has expanded its eSports coverage, such as airing the final three *CS:GO* tournaments of 2020 for tournament organizer BLAST on its iPlayer, representing about 120 hours of content.



Source: CTA Market Research

Marketers have been watching the eSports evolution — attracted by the appealing gender and age demographics of the eSports audience and its tech proclivity. Among the advertisers already involved in eSports support are IBM, Levi’s, Qualcomm, TikTok, Toyota/Lexus and Verizon.

CONNECTIONS TO TRADITIONAL SPORTS AND MEDIA

eSports offers new ways for traditional leagues and teams to satisfy sponsor commitments while also potentially tapping into new audiences, according to various analyses, which found growing interest by traditional sports fans in eSports. For example, 48% of Major League Soccer followers are also eSports viewers, according to a 2021 study by New Media Measure. For National Basketball Association fans, the overlap is 29% and for the National Football League, it’s 21%.

In June 2021, the NFL’s Baltimore Ravens announced its own Ravens Gaming League as part of a multi-year deal with Electronic Entertainment Group, a leading eSports tournament organizer. The initiative kicked off with a *Fortnite* tournament, followed by a *Madden NFL* tournament later in the summer.

CHALLENGES REMAIN

However, the industry faces a slew of technical, financial and operational challenges during this growth spurt. For example, an Intertrust report chronicled the security challenges arising in eSports, including content theft and hacking that disrupts business via piracy.

There will also be questions about how the star players are compensated. Top-earning eSports players are more influencers than elite athletes, as *Forbes* described recently. The elite are earning millions of dollars annually by leveraging their massive online followings into endorsements, fees and sponsorships.

Nonetheless, for eSports, the future is aggressively, “Game On.” ■



JANUARY 5–8, 2022 | LAS VEGAS, NV

CES 2022 Brings Tech Advances to Vegas

Proof of vaccination will be required to attend CES 2022. For the latest updates, visit [CES.tech/Logistics/Health-Protocols](https://ces.tech/Logistics/Health-Protocols).

CES® 2022 IS THE GLOBAL STAGE FOR INNOVATION — the world’s most influential technology event. CTA will convene the tech industry in person and digitally, giving a global audience access to major brands and startups, as well as the world’s most influential leaders and industry advocates.

CES is the proving ground for transformative tech including automotive tech, 5G, AI-enabled devices, digital health, sports tech, smart home, steaming content, wearables and robotics. New categories this year include: space tech, food tech and non-fungible tokens (NFTs).

Global companies to tech startups launch products at the event, build brands and partner to solve societal challenges. CES 2022 will showcase tech to improve the world. Major brands include: Amazon, AMD, Facebook, Oracle, Sierra Space, Sony, Google, Hisense, Hyundai, IBM, Intel, LG Electronics, Panasonic, Procter & Gamble, Qualcomm, Samsung Electronics and Sony.

CES 2022, owned and produced by CTA, will take place in Las Vegas, and digitally, Jan. 5-8. All attendees can access keynotes, select conference programming and exhibitor activations on the digital platform through Jan. 31, 2022. Take a sneak peek on how to best navigate the show and get a glimpse of what you’ll see this year. ■



Keynotes at CES 2022

All keynotes will be streamed live, allowing global attendees to hear breaking news and company announcements both in person and digitally.

- **CTA State of the Industry and Welcome** — Gary Shapiro, President and CEO; Karen Chupka, EVP, CES
8:30-9 AM, Jan. 5, Venetian, Palazzo Ballroom
- **General Motors – Mary Barra, Chair and CEO**
9 AM, Jan. 5, Venetian, Palazzo Ballroom
- **T-Mobile – Mike Sievert, President and CEO**
2-3 PM, Jan. 5, Venetian, Palazzo Ballroom
- **Abbott – Robert Ford, President and CEO**
9-10 AM, Jan. 6, Venetian, Palazzo Ballroom

More speakers will be announced. For updates, visit [CES.tech/keynotes](https://ces.tech/keynotes).

C SPACE

C Space at CES brings together the world’s innovators, marketers and creatives in one venue to discover disruptive tech trends and how they will change the future of brand marketing and entertainment. One of the biggest C Space events to date, this area focuses on how new technologies are impacting consumers. Leaders in content creation, major studios and top advertising firms share their experiences at keynotes and panels. Participating companies include Amazon Advertising, Discovery, DISH Network, Entercom, Innovid, NBCUniversal, Roku, Oracle, Salesforce, Samsung Ads, Snap, T-Mobile and TVSquared.



CES INNOVATION AWARDS

The CES Innovation Awards program is an annual competition honoring outstanding design and engineering in consumer technology products and distinguishes the highest rated in each category. This year, a record-breaking 1800 award entries were received.

The Innovation Awards program recognizes two levels of honorees.

- **Honoree:** A product that scores above the threshold set for a specific category.
- **Best of Innovation:** The highest-rated products in each category. Best of Innovation in each category is not guaranteed.

For more information, visit

[Innovation Awards Program — CES 2022.](#)



CES UNVEILED LAS VEGAS

The official media event of CES, CES Unveiled Las Vegas welcomes media and industry analysts before the official start of CES on Jan. 3, at the Mandalay Bay, Shorelines Exhibit Hall. The venue allows startups and global brands to show media their products and technologies, breaking news early to journalists. Media experience the world's most innovative technology, hear informative discussions from thought leaders and industry innovators and get an exclusive preview of the tech trends at CES 2022.

WORLD BANK PARTNERSHIP — GLOBAL WOMEN'S HEALTHTECH AWARDS

World Bank and CTA launched the Global Women's HealthTech Awards, recognizing innovations that leverage tech to improve women's health and safety in emerging markets. There are three program award categories: reproductive health and pregnancy, general women's health, and safety and security. Up to **12 winning solutions** will be awarded at CES 2022.

VENUES AT CES 2022

CES will take place across four venues in Las Vegas, including the new state-of-the-art **LVCC West Hall** that will feature vehicle tech and transportation. The Las Vegas Convention Center Loop is operating under the LVCC campus, connecting **West Hall** to the **North, South and Central Halls** – it's just a two-minute ride time connecting the venues.

CES 2022 PRODUCT CATEGORIES

CES showcases companies including manufacturers, developers and suppliers of consumer technology hardware, content, technology delivery systems and more. Exhibitors feature products from all facets of the consumer technology industry, including:

- 5G Technologies
- Accessibility
- Accessories
- AR/VR/XR
- Artificial Intelligence
- Audio Technologies
- Blockchain
- Car Audio
- Cloud Computing/Data
- Cybersecurity
- Digital Currency/Cryptocurrency
- Digital Health
- Digital Imaging and 3D Printing
- Drones
- Education
- Energy/Power
- Entertainment and Content
- Family and Lifestyle
- Fintech
- Fitness and Wearables
- Food Technology
- Gaming and Esports
- High-Tech Retailing/E-Commerce
- Home Entertainment Hardware
- Home Office Hardware and Accessories
- Investing
- IoT/Sensors
- Marketing and Advertising
- Mobile Hardware and Accessories
- Privacy
- Quantum Computing
- Robotics
- Smart Cities and Resilience
- Smart Home and Appliances
- Sourcing and Manufacturing
- Space Technology
- Sports Technology
- Startups
- Streaming
- Sustainability
- Travel and Tourism
- Vehicle Tech
- Video Technologies
- Wellness Technologies



EUREKA PARK

The world's entrepreneurs exhibit in Eureka Park to show off the latest advances in tech. Eureka Park features startups from 34 countries looking for investors, partners and global media exposure. Located at the Venetian Expo, participating groups include Business France, Great Britain and Northern Ireland Pavilion, Japan J-Startup JETRO, Netherland Pavilion, Samsung Electronics C-Lab, Taiwan Tech Arena, Korean Trade Investment Promotion Agency (KOTRA) and Seoul Metropolitan Government.

HONORING EXCELLENCE

THE CT HALL OF FAME honors the leaders whose contributions have helped to grow and enhance the \$487 billion consumer technology industry. Each year, we celebrate our vibrant history at this awards dinner. Created in 2000, the CT Hall of Fame will grow to 279 members with the addition of 12 new honorees. The classes of 2020 and 2021 will be inducted together since the dinner was postponed last year due to the pandemic.

This group will join inventors, promoters, entrepreneurs, journalists and industry advocates whose visions have shaped the world. These leaders have created, promoted, merchandised and advanced the products, services and technologies that empower and inspire global consumers.

The Hall of Fame program serves as a bridge from the past to the present, enabling a new generation of entrepreneurs to build on the foundation laid by their colleagues before them.

We also are celebrating the 2020 and 2021 Innovation Entrepreneur Award honorees. This program recognizes the extraordinary contributions of executives, small businesses and startups. And CES is the home of innovation. Come see the potential of technology to connect the world and empower each of us at [CES 2022](#).



Gary Shapiro,
President and CEO

THE JUDGING PROCESS

The 2020 and 2021 classes were selected by separate panels of judges including media and industry professionals, who evaluated the nominations submitted by manufacturers, retailers and journalists. We thank the following judges for volunteering their time for both the **CT Hall of Fame** and **Innovation Entrepreneur Award** programs:

2021 CT HALL OF FAME JUDGES

- LANCELOT BRAITHWAITE**
Berger-Braithwaite Labs, **2011 HOF**
- CAROL CAMPBELL**
Technology Insider Group
- HENRY CHIARELLI**
Chiarelli & Associates, **2019 HOF**
- DEENA GHAZARIAN**
Austere
- JEREMY KAPLAN**
Future
- MARA LEWIS**
ID8 Innovation
- DANIEL PIDGEON**
Sears Home Services
- MEGAN POLLOCK**
Samsung
- JOHN SHALAM**
VOXX International, **2009 HOF**
- MURRAY SLOVICK**
Intelligent Content Services
- STEVE SMITH**
Formerly *TWICE*, **2016 HOF**
- JOHN TAYLOR**
LG
- STEWART WOLPIN**
Tech historian

2020 CT HALL OF FAME JUDGES

- RICK ALBUCK**
2020 Companies
- MELISSA ANDRESKO**
Lutron
- TOM CAMPBELL**
Video and Audio Center, **2015 HOF**
- ROB CALEM**
Journalist, *i3*
- MARGE COSTELLO**
Costello Communications
- BOB FIELDS**
Hibersense
- PAM GOLDEN**
GLA Communications
- CHERYL GOODMAN**
Sony Electronics
- SUZANNE KANTRA**
Techlicious
- NANCY KLOSEK**
Dealerscope
- STEVE SMITH**
Formerly *TWICE*
- GREG TARR**
HD Guru.com
- STEVE TIFFEN**
Tiffen
- LOIS WHITMAN**
HWH New Media

2020 AND 2021 INNOVATION ENTREPRENEUR AWARD JUDGES

- DAVE ARLAND**
Arland Communications
- KIM FOLSOM**
Founders First Capital Partners LLC
- CONNIE GUGLIELMO**
CNET
- PAM GOLDEN**
GLA Communications
- ROBERT HEIBLIM**
bluesalve partners
- SUZANNE KANTRA**
Techlicious
- JEREMY KAPLAN**
Future
- MARA LEWIS**
ID8 Innovation
- FRANK PARROTTO**
Matrix Advisors
- JOHN QUAIN**
NYT, Tom's Guide
- LARRY RICHENSTEIN**
WePower Technologies
- PAUL SABBAAH**
Stamford International
- GARY YACOUBIAN**
SVS | Specialty Technologies

2022 HALL OF FAME

Nominate a leader for the 2022 Hall of Fame that has made a significant impact on the industry by filling out the form at [CTA.tech](#).

CES 2022

Join us at [CES® 2022](#) on January 5-8 in Las Vegas, the global stage for innovation and the world's most influential technology event. For more information, visit [CES.tech](#).

Mike Fasulo

SONY PRESIDENT & COO

(1957 –)



For nearly four decades in a dozen different roles including seven years as president and COO of Sony Electronics, Mike Fasulo drove innovation and achieved record profitability while empowering and curating a diverse bench of leaders before diversity, equity, and inclusion were considered strategic imperatives. Known both as Scrappy as well as GSD – Get Stuff (or S_) Done, Fasulo inspired not only Sony but the industry to activate the full measure of talent to achieve better business as well as societal outcomes.

Born in Teaneck, NJ, Fasulo's work ethic was formed by his hard-working parents, Larry, a bus driver, and Mary, mother to three. Not a stellar student, Fasulo was badly advised by his Hackensack High School counselor to skip college. After two years in construction, Fasulo followed his instincts and enrolled in Rowan University, graduating in 1982 with a BS in finance and accounting.

After two years as controller at a telecommunications startup, Fasulo joined Sony in February 1984 as a junior financial analyst. He soon was made Sony's first-ever operations manager, helping to create an automated career development and review process. Based on the

As president and COO of Sony Electronics, Mike Fasulo drove innovation and achieved record profitability while empowering and curating a diverse bench of leaders.

program's success, Sony rolled out both operations managers and his career development tool kit nationwide. Sony acknowledged Fasulo's impact by awarding him its coveted Samurai Award in 1990.

Fasulo relocated to San Francisco from 1989 to 1994 to lead Sony's northwest region sales team. Then the youngest sales VP in Sony Americas' history, Fasulo and his team earned the company's "Region of the Year" award four consecutive years. Back to Sony's Park Ridge, NJ, HQ as eastern sales VP, Fasulo established a relationship with Circuit City that generated more than \$1 billion in revenue.

During a limo ride at CES 1999, Fasulo was promoted to second-in-command for recording media. After replacing the leadership

team, Fasulo listened to both employee and customer feedback, and soon transformed the division from worst to Sony Electronics' second-most profitable entity and was quickly promoted to division president. In 2002, Fasulo was appointed president of Sony E-Solutions, Sony's segue into e-commerce, Sony retail stores, and the Sony Style branding. Initially seen as a failure, Fasulo quickly turned that business around as well.

In 2005, Fasulo became only the second CMO in Sony's history, and launched the nationwide HDNA — "High Definition; it's in our DNA" — marketing campaign to accelerate transition from analog to digital TV. With celebrities boosting the brand, Sony regained the #1 TV market share. In 2010, Fasulo was once

again promoted, this time to EVP of overall sales and operations.

On a Friday afternoon in January 2014, Fasulo received a call from his boss in Japan asking to meet with him in San Diego the following Monday for an 8am breakfast. After hanging up, Fasulo said to his wife, Pat, "I'm either getting fired or promoted." Fasulo was promoted to president and COO of Sony Electronics U.S.

With Sony Electronics losing money, market share, and revenue, Fasulo successfully led another turn-around. The U.S. soon became Sony's most profitable region.

One of Fasulo's most rewarding initiatives were the Fast Forward program, designed to engage Sony's workforce to overcome business challenges in operations and develop a "ready now" strategy so executives would be prepared for their next roles, and his championing and promotion of women executives. Fasulo noted that his varied Sony career "was almost like going to different companies and learning different things. Some say I just can't keep a job, but I look at it like I'm well-rounded."

In 2021, Fasulo retired from Sony, becoming an executive advisor. ■

Nancy Klosek

PIONEERING TECHNOLOGY JOURNALIST

(1956 –)

Nancy Klosek carved out a consumer technology reporting career buoyed by a cheerful disposition that enabled her to establish professional relationships with Japanese and other industry executives through nearly four decades of reporting.

Born in Brooklyn, NY, on January 26, 1956, Klosek was the only child of Anthony and Edith, who grew up during The Depression and married in their early 40s. Her father's mind-expanding interests such as oil painting and working on *The New York Times* crossword puzzle helped distract him from his factory job; her mother was "a terrific Northern Italian cook" and a full-time homemaker.

Klosek went to Catholic school and then graduated from New York University in 1977 with a B.A. in English and a minor in Journalism. Klosek was one of her high school yearbook editors but her interest in reporting was sparked by Woodward and Bernstein, inspired by how the pair could "dig for facts, piece them together, and move the course of the whole country with their words alone."



Nancy's comprehensive reporting while chronicling the consumer technology landscape over the years, has made her a well-liked and respected journalist.

Fresh out of college, Klosek scored a job at the trade magazine *Boating Industry*, where she met tech journalists Steve Booth and Paul Gluckman. When Booth moved to *Audio Times*, he recommended adding Klosek to the magazine's freelance pool. In 1983, Gluckman, who had moved to *AudioVideo International (AVI) Magazine*, owned by the Tokyo-based publisher Dempa Publications, told Klosek of a full-time job opening, and she was hired.

Her initial AVI assignment was covering Philips' U.S. introduction of its Compact Disc player — her first taste of the fast pace of the consumer tech industry.

Klosek spent the next 21 years at AVI, most of them as the magazine's managing editor. Over more than three dozen trips to Japan, she developed a deep affinity for Japanese culture, which gave her a unique vantage point from which to report on Japanese brands in the 1980s and early 1990s. Klosek

also cultivated enduring relationships with her Japanese colleagues while helping them acclimate to life in America.

Klosek was hired in 2004 as the New York editor for two NAPCO Media publications, *Dealerscope* and *Custom Retailer*. She served as the editor-in-chief of *Dealerscope* from 2014 until her retirement in early 2021. She also served as the editor-in-chief for NAPCO's *Connected Design Magazine*, starting in 2017. She is currently a contributing editor for CT Lab Global Media.

For her work, she was presented with *Dealerscope's* Powerful Women in Consumer Technology Award (2016) and also its Hall of Fame Award (2021).

Throughout her career, Klosek has considered herself a "sticker." She lives in the Ridgewood, Queens, NY, home in which she was raised. This "stickiness," combined with comprehensive reporting while chronicling the consumer technology landscape over the years, has made her a well-liked and respected journalist. ■

William “Bill” Pearse Barbara “Barb” Pearse

FOUNDERS, ULTIMATE ELECTRONICS

Bill and Barb Pearse built Ultimate Electronics from a single mom-and-pop A/V shop in a Denver suburb into a 65-store behemoth stretching across 14 states from Minnesota to Texas by being the ultimate in selling the newest gear, offering the widest selection, establishing high customer loyalty, and providing excellent customer service.

Bill, born in Ann Arbor, MI, in August 1941, and Barb, born in April 1943, in Minneapolis, MN, both showed early aptitudes for their later career together. Bill started building and flying competitive model airplanes in his teens, while working at a hobby shop. At the age of 10, Barb started working for her father, who ran various Minnesota State Fair restaurants, and at 15 was managing one of them, handling hiring, buying and bookkeeping.

Bill hitchhiked his way to Yellowstone National Park for a summer job in 1962. At the Canyon Village Lodge dining room, Bill saw Barb and knew immediately he would marry her. He arranged to be her bus boy almost every

day that summer, and soon discovered the feelings were mutual. By their third summer in Yellowstone, they were engaged and Bill was running Old Faithful Lodge.

After each graduated college in 1965, the pair married, moved to Denver, found jobs, and started saving to buy a consumer electronics franchise. Working as a factory foreman, Bill scoured each new “Franchise” magazine and discovered Minneapolis, MN-based Team Electronics

and, on October 12, 1968, with \$15,000 they had saved, the Pearses opened a 2,000-square foot franchise outlet in Wheat Ridge, CO.

In 1973, the couple transformed their Team Electronics location into their own SoundTrack store. They credit their exponential growth to hiring their right-hand man, Dave Workman; innovative promotions such as “Buy this stereo system and get a free waterbed!”; and Bill’s founding of the PRO Buying Group.

By 1993, the SoundTrack stores were generating net sales of \$53.7 million. The Pearses went public, and combined their outlets under the Ultimate Electronics umbrella. Ultimate’s meteoric growth was due to clever promotions such as “Buy a TV from Ultimate during this NFL season, and if the Broncos win the SuperBowl, we’ll give you a full refund for your TV,” and by maintaining a simplified management style. Everyone carried a copy of Bill’s “Operations Manual,” a two-sided business card that expressed two operating philosophies: “Treat all customers and everyone you work with as you would like to be treated,” and “Use your own best judgement at all times.” For added incentive, the Pearse’s promoted all store managers from within the company.

By 2000, Ultimate Electronics reached its peak sales revenues of \$713 million, employing more than 4,000 in upscale 40,000-square-foot stores. The Pearses were the recipients of nearly every retailer award extant, earning the admiration of the industry. ■



[1941 –]

[1943 –]

By 2000, Ultimate Electronics reached its peak sales revenues of \$713 million, employing more than 4,000 employees in upscale 40,000-square-foot stores.

Roberta Williams

CO-FOUNDER SIERRA ON-LINE, CREATOR OF GRAPHIC ADVENTURE GAMES

(1953 –)



Although, her experience with computers was limited, Roberta Williams, a zealous fan of the first adventure game, decided to create her own. With her husband Ken, Roberta co-founded Sierra On-line and created the first graphical adventure game, *Mystery House*, that pioneered a new industry.

Born February 16, 1953, in Pasadena, CA, her parents encouraged “thinking” games to spark her imagination.

In 1971, Roberta, an avid reader of fantasy and fairy tales, married Ken Williams, a “natural tech guy.” Roberta took a job as a typist clerk, then became an IBM 360 computer operator before becoming a beginning COBOL programmer for Lawry’s Foods. Ken worked as an IBM programmer, and Roberta continued to work while raising their children.

Roberta became an obsessive fan of the early text-based PC adventure games such as *Colossal Cave*. In 1980, the couple gifted each other an Apple II, primarily for Ken to develop a FORTRAN compiler. Roberta was drawing sketches of

her own adventure game, a murder mystery inspired by the board game *Clue* and Agatha Christie’s novel *And Then There Were None*, with game-play elements gleaned from the text adventure games she enjoyed. Roberta then added her own unique touch: graphics.

Roberta worked on her graphically gothic Victorian murder game for weeks. Knowing Ken was the better programmer, Roberta convinced him to program her game, dubbed *Hi-Res Adventure*. Ken wrote the software for a VersaWriter, a tablet with a mechanical arm, to digitize Roberta’s

hand-drawn images and create the game’s roughly 70 illustrations. He then squeezed the game’s 100-plus game settings and pathways into 59kb to fit on a single 5.25-inch floppy disk.

To sell the game, the pair founded On-Line Systems in May 1980. Priced at \$24.95 and packaged in a Ziploc bag with photocopied instructions, the Williamses placed ads in computing magazines and demonstrated the game, titled *Mystery House*, at local computer shops. They sold more than 80,000 copies, making it a best-selling phenomenon.

Capitalizing on this success, Roberta created, and Ken coded *The Wizard and the Princess* later that year, the first full-color computer game that sold more than 100,000 copies. *Princess* later spawned Sierra’s *King’s Quest* series, which sold more than seven million copies.

Now renamed Sierra On-line, the Williamses established offices in Oakhurst and attracted enthusiastic programmers and artists/animators. In 1988, Roberta created *King’s Quest IV: The Perils of Rosella*.

Featuring the first female lead in a computer game, *Rosella* sold 100,000 copies in its first two weeks, which led to a series of Sierra female-centric adventures. In 1995, Sierra released *Phantasmagoria*, the first live-action video game. Featuring two dozen real actors placed against computerized 3D backdrops, *Phantasmagoria*, packaged on seven CD-ROMs, cost \$4.5 million to produce but made \$12 million to become the country’s top-selling game.

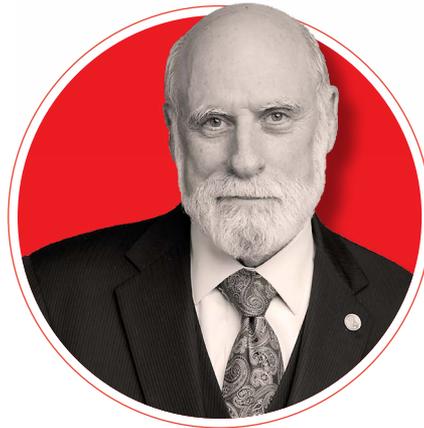
In 1996, the Williams’ sold Sierra On-line, and Roberta became a legendary figure of her own. ■

Roberta co-founded Sierra On-line and created the first graphical adventure game, *Mystery House*, that pioneered a new industry.

Vinton Gray “Vint” Cerf

CO-INVENTOR OF TCP/IP; “FATHER OF THE INTERNET”

(JUNE 23, 1943 –)



**Vint Cerf has been dubbed
“Father of the Internet.”**

Along with Bob Kahn, Vint Cerf has been dubbed “Father of the Internet.” He and Kahn led the development of TCP/IP (Transmission Control Protocol/Internet Protocol), the fundamental communications protocols that determine how data is packaged, addressed, transmitted, routed and received over the Internet.

Born in New Haven, CT, on June 23, 1943, to Muriel and Vinton T. Cerf, the family moved to Southern California when he was three. While attending Van Nuys High School, Cerf worked at Rocketdyne on the Apollo program, helping to write statistical analysis software. After earning a mathematics degree from Stanford in 1965, Cerf worked for IBM in Los Angeles as a systems engineer on the company’s Quiktran computer time-share operating system.

Cerf left IBM in 1967 to pursue advanced degrees at UCLA, earning a master’s in 1970 and his Ph.D in 1972. While at UCLA, Cerf worked with the pioneering networking group that connected the first four nodes of the ARPANET, the network initiative of the

U.S. Department of Defense’s DARPA (Defense Advanced Research Projects Agency), and first worked with Bob Kahn, who later initiated DARPA’s Internet project. In 1972, Kahn organized a successful public demonstration of the new ARPANET system, which Cerf had spent the summer working on. Cerf returned to Stanford as an assistant professor that fall when Kahn recruited him to help develop a replacement for ARPANET’s Network Control Program (NCP) host protocol.

What was needed was a robust but “open” packet-switching architecture that would work on any computer, mobile or fixed, on any network running any operating system, and that didn’t rely on a single control component or point of failure — failing to find one clear path through the network, encrypted data would be automatically re-routed to

reach the intended destination. Within a year, the pair and their team had developed the Transmission Control Protocol (TCP), which became a fundamental protocol of the internet. In 1974, Cerf and Kahn co-published the first description of the TCP protocol, *A Protocol for Packet Network Intercommunication*.

In 1976, Cerf officially joined Kahn at DARPA in Washington, D.C., where the pair led TCP’s refinement. By 1983, TCP — now known as TCP/IP — was adopted for both ARPANET and other military communication systems. Over the next decade, TCP/IP was adopted by corporate and academic users as well as PC makers, becoming the default digital communications standard and making the internet possible.

In 1982, Cerf left DARPA to become VP of Digital Information Services for

MCI, where he led the development of MCI Mail, the first commercial email service connected to the internet. Four years later, he re-joined Kahn, who had founded the Corporation for National Research Initiatives, where the pair worked on digital libraries, robots and gigabit networks. In 1992, Cerf and Kahn helped co-found the Internet Society (ISOC), and Cerf served as its first president. He rejoined MCI as SVP of Technology Strategy in 1994. Both Cerf and his wife, Sigrid, are hearing-impaired; in 1997, he joined the board of trustees at Gallaudet University for deaf and hearing-impaired students.

Cerf helped found and fund ICANN (Internet Corporation for Assigned Names and Numbers) and served on the organization’s board from 1999 to 2007, serving as chair from 2000. In 2005, Cerf joined Google as VP and Chief Internet Evangelist, and from 2013–2016, he served on the President’s National Science Board.

Cerf and Kahn have been continually honored for their contributions; in 2004, the pair was awarded the Turing Award, and a year later, the Presidential Medal of Freedom. ■

Frank Conrad

RADIO PIONEER; DESIGNED FIRST CONSUMER ELECTRONICS PRODUCT

(MAY 4, 1874 – DECEMBER 11, 1941)



During his lifetime, Frank Conrad was referred to as “the father of commercial radio” for his seminal role in launching KDKA in Pittsburgh, the first “commercial” radio station. Conrad also designed the RA-DA, the first factory-produced mass market radio — essentially, the first consumer electronics product — in November 1920.

Born May 4, 1874, in Pittsburgh, when he was 16, he went to work for Westinghouse as a bench-hand. In 1897, he was promoted to the company’s testing department, then to general engineer in 1904.

Conrad’s interest in radio was sparked in 1912 by a \$3 bet with a co-worker about who owned the most accurate watch. To prove his claim, Conrad built a crude receiving set to pick up time signals transmitted by the Naval Radio Station in Arlington, VA. Conrad also built his own wireless station and lab in his garage. After the U.S. entered the first World War in April 1917, Conrad was recruited by the government to develop wireless equipment for the military.

After the war ended, on Friday night, October 17, 1919, he transmitted opera, jazz and orchestral music for two hours. He was soon transmitting regular Saturday night “radiophone” concerts. By the spring of 1920, his concerts could be tuned into from 600 miles away. Conrad also was developing his new home receiver, and applied for patents on his tuning and antennae technologies in 1920.

Conrad’s broadcasts became so popular that on September 29, 1920, a Pittsburgh department store, Joseph Horne, ran an “ad” touting Conrad’s concerts

and \$10 radio sets that could be bought to tune-in. The ad caught the eye of Westinghouse VP Harry Phillips Davis, who asked Conrad if he could build an even more powerful transmitting station on the roof of Westinghouse’s Pittsburgh headquarters.

At 8pm on November 2, 1920, Westinghouse’s newly-named KDKA started broadcasting returns of the Warren Harding-James Cox U.S. presidential election. But Conrad was manning his own rig in his garage as a back-up in case the main station failed.

With the success of the broadcast, Westinghouse manufactured Conrad’s

two-piece RA-DA home radio receiver — one cabinet containing the tuner, the second a detector and a two-stage audio amplifier. The RA-DA was powered by a rechargeable lead acid battery, and was equipped with three headphone jacks — there was no speaker. Each piece was priced at \$65, about \$1,670 in today’s dollars for both pieces. The first production run at Westinghouse’s Shadyside Works in Pittsburgh produced about 1,400 RAs and 1,600 DAs, the first sets coming off the line on November 30, 1920, with production shifting to Westinghouse’s Electric Home Appliance Division in East Springfield, MA. A combined 144,000 of Conrad’s creation were sold over two years, launching the age of mass communications.

As assistant chief engineer of Westinghouse, Conrad continued his pioneering work in shortwave radio. He received numerous honorary degrees and awards, including a Doctor of Science from the University of Pittsburgh in 1928, and over 200 patents during his 51-year Westinghouse career. ■

Peter M. Fannon

PRESIDENT, ATTC; PANASONIC GOVERNMENT AFFAIRS VP

(MAY 21, 1948 –)



Peter Fannon successfully organized and led the Advanced Television Test Center (ATTC), helping to develop HDTV.

Admittedly, he didn't know much about the new-fangled "HDTV." But thanks to his management and tested political skills, Peter Fannon successfully organized and led the Advanced Television Test Center (ATTC), helping to develop HDTV. Fannon then served as Panasonic's lead lobbyist in Washington, D.C. Between these and other prominent positions, Fannon became one of the most influential and ubiquitous figures in the consumer technology industry for four decades.

Born in Delaware, his father, Marcy, was an aeronautical engineer and airline executive. The family settled in Bronxville, NY, where his mother, Betty, co-owned a real estate firm. As a 1950s baby boomer, Fannon was hooked on the magic of TV during its transitions from monochrome to color, and from live to taped programming. He was his high school's "accredited" AV aide when local New York TV personalities gave school presentations.

After spending his senior year in high school in Malmö, Sweden, via the AFS Student Exchange program, Fannon earned his AB and MA degrees in international relations from Johns Hopkins University's

School of Advanced International Studies, studying in Bologna, Italy, and Washington, D.C. While in school, Fannon made his first White House visits as a D.C. tour guide.

Fannon joined the General Services Administration (GSA) after graduation, then the Office of Management & Budget (OMB), working on communications agencies' budgets, D.C. "Home Rule" activities and U.S. Bicentennial plans. He helped draft the first long-term funding authorization for CPB/public broadcasting (1975) and the legislation establishing NTIA/National Telecommunications & Information Administration (1977). Fannon became PBS's first director of planning in 1977, proposing new program networks and advancing new technologies including closed captioning, stereo audio and satellite networking. In 1980,

he moved over to launch the National Association of Public Television Stations (NAPTS), where he helped lobby against administration cuts to CPB funding and fought for cable carriage for public TV stations.

In 1988, Fannon got a call from NAB VP John Abel about leading the just-chartered ATTC. While Fannon was not a TV engineer, his government, TV broadcasting and technical experience was a unique combination. As ATTC president, Fannon helped raise funding, hired technical staff, and developed the purpose-built testing lab in Alexandria, VA. Then, under the aegis of the FCC's Advisory Committee, he helped pull together the often-contentious broadcast, government, TV manufacturer and technology constituencies to design the tests of the competing "advanced television system" proposals. Winnowed

down from 21 proposals, six systems were tested. After two withdrew, the backers of the remaining four systems formed the Grand Alliance, combining the best aspects of each, helped by some ATTC sub-component "bake-offs" tests. Based on GA tests, the FCC adopted the new "digital HDTV standard" on Christmas Eve 1996. ATTC was awarded an Emmy for its work.

With the testing done, Fannon revived his "theater career," singing and dancing in the musical "1776" as Richard Henry Lee, with several of the other Founding Fathers portrayed by members of Congress.

To help implement HDTV, Fannon joined Panasonic as VP of corporate and government affairs. Over the next 21 years, he helped promote the broadcast digital and HDTV transition and the new HDTV products, especially plasma flat-screen TVs. Fannon also managed Panasonic's environmental, product safety, regulatory compliance, communications and community outreach activities, before retiring in 2018.

Over the years, Fannon chaired or served on many CTA boards and committees, and was a "Visionary" contributor to the CTA PAC since its founding. ■

Kazuo Kaz Hirai

PRESIDENT AND CEO, SONY CORP.

(DECEMBER 22, 1960 –)



Through passion, hard work, prescient business acumen and a strong love of products and content, Kazuo Hirai began with Sony in 1984 and ultimately rose to the role of president and CEO, from April 2012 to March 2018. He is known for taking the reins during a challenging time for the company and, over the course of his tenure, turning it around with his “One Sony” strategy, into an innovation powerhouse, and hands-down leader across multiple product categories. His charisma, leadership and results earned him a spot-on *Entertainment Weekly’s* list of the most influential and intellectual executives globally.

Born December 22, 1960 in Tokyo, Japan, the son of a banker, Hirai spent many of his years growing up living in New York, Toronto and California. He developed a strong interest in electronics products, which influenced his future success in business.

In 1984, after graduating with a liberal arts degree from the International Christian University in Japan, Hirai took a role with CBS/Sony Inc. (now Sony Music

Hirai successfully turned around Sony’s business with record-high profits in FY2018.

Entertainment (Japan) Inc.) where he assisted in the marketing of international music in Japan. Hirai was in his element and rapidly rose through the ranks moving to New York to lead the marketing of Sony Music Japan artists within the U.S. While in New York, he assisted the 1995 launch of the PlayStation® console by Sony Computer Entertainment America (SCEA), subsequently becoming the executive vice president of SCEA in 1996, and president in 1999. Under Hirai’s leadership, the SCEA division blossomed and retained strong revenue growth for nearly a decade.

His success in the U.S. brought him back to Tokyo in 2006, when Hirai was elevated to president and COO of Sony Computer Entertainment Inc. (SCEI),

and soon after, lead Sony’s entire game business as CEO. Hirai’s successes mounted as he accumulated additional responsibilities and leadership roles in Sony Corp., as president of Consumer Products & Services Group, in tandem with SCEI, overseeing Sony’s entire portfolio of consumer electronics products and digital networked services. In April 2012, Hirai was appointed president and CEO of Sony Corp.

Widely respected for his facile understanding of a fast-changing digital world, Hirai’s status as a visionary in the industry was cemented through his marketing of international music with Sony Music Entertainment, his successful leadership of the evolving PlayStation business, and a masterful integration and innovation

between Sony’s multiple electronics products and services. He passionately encouraged many new business incubation initiatives including iconic robotics like Aibo. Consequently, Hirai successfully turned around Sony’s business with record-high profits in FY2018.

Lauded for his innovation, leadership and vision, Hirai received the Lifetime Achievement Award from The National Academy of Television Arts & Sciences (NATAS) at the 66th Annual Technology & Engineering Emmy Awards on January 8, 2015, at CES. In 2017 *Variety* profiled Hirai as part of its Variety500 Honoree list.

In 2018, after six years as president and CEO, Hirai stepped down, to be replaced by then-CFO Kenichiro Yoshida, who now serves as chairman, president and CEO of Sony Corp. Hirai actively assisted in a smooth leadership transition to Yoshida and has voiced strong support for his successor. Although not serving actively in a formal role, Hirai remains an on-call senior advisor to the company. ■

Robert Elliot “Bob” Kahn

CO-INVENTOR OF TCP/IP; “FATHER OF THE INTERNET”

[DECEMBER 23, 1938 –]



**Bob Kahn has been dubbed
“Father of the Internet.”**

Along with Vint Cerf, Bob Kahn has been dubbed “Father of the Internet.” Kahn and Cerf led the development of TCP/IP (Transmission Control Protocol/Internet Protocol), the fundamental communications protocols that determine how data is packaged, addressed, transmitted, routed and received over the internet.

Kahn was born December 23, 1938, in Brooklyn, NY. Kahn’s father helped design a record-keeping database, which may have influenced his son’s career. With an interest in mathematics and communications, Kahn enrolled in Queens College – now part of the City College of New York. After graduating with a degree in electrical engineering in 1960, Kahn took a job at Bell Labs at its West Street headquarters in lower Manhattan, where he first encountered a computer. Kahn soon received an NSF fellowship and enrolled at Princeton, earning his electrical engineering master’s and Ph.D degrees, then was accepted for a post-doctoral fellowship and assistant professorship at MIT.

In 1966, Kahn joined the pioneering R&D firm BBN, helping to write the

proposals to work on ARPANET (Advanced Research Projects Agency Network), the computer network initiative of the U.S. Department of Defense’s DARPA (Defense Advanced Research Projects Agency) project.

While working on four nodes of the nascent ARPANET for BBN, Kahn met Vint Cerf, who was working in a networking group at UCLA that had connected the first two nodes of the network. Kahn then officially joined Information Processing Techniques Office (IPTO) within DARPA in Washington, D.C., in 1972, and organized a successful public demonstration of the new ARPANET system. Kahn then recruited Cerf to help develop a replacement for ARPANET’s Network Control Program (NCP) host protocol.

What was needed was a robust but “open” packet-

switching architecture that would work on any computer, mobile or fixed, on any network running any operating system, and that didn’t rely on a single control component or point of failure — failing to find one clear path through the network, encrypted data would be automatically re-routed to reach the intended destination. Within a year, the pair and their team had developed the Transmission Control Protocol (TCP), which became a fundamental protocol of the internet. In 1974, Cerf and Kahn co-published the first description of the TCP protocol, A Protocol for Packet Network Intercommunication.

While at DARPA, Kahn worked on end-to-end security, packet radio, packetized speech technology, the precursor to VoIP, and several other network aspects, and soon

appointed chief scientist and deputy director. In 1976, Cerf officially joined Kahn at DARPA, where the pair worked for six years on TCP’s refinement. By 1983, TCP — now known as TCP/IP — was adopted for both ARPANET and other military communication systems. Over the next decade, TCP/IP was adopted by corporate and academic users as well as PC makers, becoming the default digital communications standard and making the internet possible.

In 1979, Kahn became director of IPTO, initiating and leading the billion-dollar Strategic Computing Initiative to help develop machine intelligence. Kahn left DARPA in 1986, and founded the non-profit Corporation for National Research Initiatives (CNRI), where he has continued to serve as chairman, CEO and president. In 1992, Kahn and Cerf, also representing CNRI, helped co-found the Internet Society (ISOC).

Kahn and Cerf have been continually honored for their contributions; in 2004, the pair was awarded the Turing Award, and a year later were awarded the Presidential Medal of Freedom. ■

James E. “Jim” Meyer

LONGTIME RCA, SIRIUS XM EXECUTIVE

(OCTOBER 27, 1954 –)



As an executive at RCA/GE, Thomson and SiriusXM, Jim Meyer has been a prominent presence in the development, promotion and success of some of the most innovative and much-loved consumer technologies of the last 40 years.

He was born on October 27, 1954, in Boston to Margaret and U.S. Navy Admiral Wayne Meyer. His father an engineer by training, passed on to his son the message of the power of engineering. Rather than pursue a military career, Meyer was intrigued by building things and how they worked.

After earning his bachelor's degree in economics at St. Bonaventure in 1976, Meyer got a job as a financial analyst for a division of RCA outside Washington, D.C. Except Meyer was too diligent. After writing a report that eliminated two-thirds of his own job, he returned to St. Bonaventure to earn his MBA in 1979. Meyer then returned to RCA in the company's consumer electronics division in

In 2008, Meyer was instrumental in combining Sirius with XM to form SiriusXM.

Indianapolis. Working on the operations side of the business, Meyer managed the company's capital budget while learning how products were made, and found he was keenly interested in consumer electronics.

In 1985, Meyer met Joe Clayton (CTA HoF 2008), then the new VP of marketing operations, who became both a friend and mentor. Meyer had moved into sales. In 1988, RCA/GE was sold to French conglomerate Thomson, which forced Meyer to adopt a more global sales and product philosophy. In 1989, he became SVP of product management with oversight of TVs, VCRs, camcorders, cordless phones and a range of audio products.

In 1990, RCA Thomson approached Eddy

Hartenstein (CTA HoF 2008), president of GM's Hughes division, about a new high-powered satellite TV system. Meyer and Clayton, believed it would vastly change the consumer experience and it was important to take a leadership role in the technology. Meyer said to Clayton, "Let's bid on that business." Within seven months of DirecTV's launch in June 1994, RCA Thomson had sold one million systems.

Soon after DirecTV launched, Meyer got a call from Warner Home Video chief Warren Lieberfarb (CTA HoF 2008). The pair discussed the idea of putting movies on optical disc, a technology for which RCA owned important patents. DVD would storm the market in 1997, and Meyer helped oversee the launch in the U.S.

In 2003, Meyer got another call from Clayton, now CEO of the nascent Sirius Satellite Radio. "What do you know about satellite radio?" Clayton asked. Meyer replied, "I think it is the stupidest idea, why would people pay for radio?" Clayton then implored Meyer, "Jim, you need to come help me!" After only a week at Sirius, Meyer was infatuated with the product.

At the time, Sirius had 60,000 subscribers. Meyer established the vital relationships with after-market retailers and with automakers to install satellite radios. The hiring of Howard Stern in 2004 was a landmark move for Sirius, which was in a pitched battle with competitor XM. In 2008, Meyer was instrumental in combining Sirius with XM to form SiriusXM. After serving as interim, he was named permanent CEO in 2013. By 2020, Sirius XM had grown to more than 38 million subscribers and become the leading audio entertainment company in the U.S. Meyer retired from SiriusXM on Dec. 31, 2020. He also serves on the board of Charter Communications. ■

Robin Raskin

JOURNALIST, FOUNDER LIVING IN DIGITAL TIMES

(1954 –)



Robin Raskin has always been a translator between the tech sphere and the rest of the world. After 20 years as a pioneering consumer technology journalist, editor, and children and internet safety expert, Raskin wanted to try something new. Living in Digital Times, founded in 2006 now is an integral and popular 15-event conference/exhibit series at CES.

Born in The Bronx on May 14, 1954, she is the eldest of four children of Frances Kfare and Lester Raskin, a lawyer. Growing up in Queens, her father demanded his children recite current events or no dinner, and report on three new dictionary words each Sunday. She described herself as being “toilet trained with a book in my hand.” A number of writing awards in school put the communications bug in her ear.

While earning her BA at Franklin & Marshall College in the mid-1970s, she learned about audio by attending rock concerts with her roadie boyfriend. After college, she married Kaare Christian, a computer graphics engineer at New York Institute of

Technology (NYIT). Their early dates involved learning to wire wrap circuit boards and watching mainframe computers construct images pixel-by-pixel. As a wedding gift, the president of NYIT awarded Raskin a scholarship and a keyboard connected to the school’s DEC VAX, and her husband taught her UNIX VI, NROFF and TROFF. These experiences led to her first technology freelance writing gig in 1979, earning \$25 from *InfoWorld* for “How I Learned About Computers to Save Our Marriage,” which encouraged women to learn about then new home computers.

A mother of three, Raskin freelanced, writing about computers and printers

for Scholastic’s *Home Office PC*, *PC Magazine*, *Computer Shopper*, and numerous others. Once her children were in school, she joined *PC Magazine* as senior editor, promoted to editor in 1990. Raskin left *PC Magazine* to found *FamilyPC*, a joint venture of Disney and Ziff Publishing, to provide guidance to families grappling with new tech. She also wrote tech pieces for national publications such as *USA Today*, *Yahoo!*, *Good Housekeeping*, *Redbook* and *Elle*, and wrote and edited six books on kids and family technology.

Raskin also served on the National Academy of Sciences committee on kids’ safety on the internet, and testified

before various Congressional committees regarding the Children’s Online Privacy Protection Act (COPPA). She won numerous awards, and was a frequent visitor to the White House during the Clinton Administration as part of a women’s delegation of magazine editors.

In 2006, she approached CTA President and CEO Gary Shapiro about creating a series of CES conferences. The conference and exhibit area were devoted to Kids and Families in 2007. As the events grew in popularity, Raskin added more events, including Baby Tech, Digital Health, Fitness Tech, Digital Money, High Tech Retailing, and some fun events, like The Last Gadget Standing and FashionWare.

Living in Digital Times continued to grow at the Sands Expo and Convention Center. In 2019, CTA purchased Living in Digital Times, and Raskin and her team continue to consult. Her new company, Solving for Tech, amplifies the message that technology and innovation needs to be understood, deployed and shared by all. ■

2021



DR. JAMES MAULT

2021 EXECUTIVE OF THE YEAR **Dr. James Mault**

“Medical Grade Remote Care is Here,” proclaims the home page of BioIntelliSense, founded by Dr. James Mault. He has perhaps done more than any individual to pioneer technology-based solutions for remote patient monitoring and to drive virtual medical care to routine clinical practice. Through its medical-grade Data-as-a-Service platform and wearable devices, Dr. Mault and BioIntelliSense have helped usher in the era of virtual health.

James Mault, born in 1961, grew up in Olmsted Falls, Ohio, where his parents were teachers. His dream of becoming a surgeon began after attending a medical seminar in seventh grade. When his father died during his first week of college, Dr. Mault sought employment at the University of Michigan Hospital to self-finance his education. He was hired as a medical technician by Dr. Robert Bartlett, a highly regarded surgeon-entrepreneur. Surrounded by technology in the ICU, Dr. Mault built his first medical device and authored his first medical journal article at 19. At the same time, he earned his bachelors and cum laude medical degrees from the University of Michigan in 1984 and 1988, respectively, and completed his general and cardiothoracic surgery residency at Duke University Medical Center in 1997. He then joined the faculty of the University of Colorado Health where he practiced thoracic surgery, heart and lung transplantation, and served as Chief of Thoracic Surgery at the Denver VAH.



NUHEARA



ELNAZ SARRAF, ROYBI

great promise to transform the delivery of health care,” Dr. Mault says. “We are finally at that tipping point in using technology to enable better healthcare to more people at a fraction of the cost.” Because of his work in virtual care and remote patient monitoring, patients can now be safely cared for at home.

2021 COMPANY OF THE YEAR **Nuheara**

Since the introduction of its first IQbuds with augmented hearing capabilities in 2016, Nuheara has been a pioneer in the “hearables” category, with its recent IQbuds2 Max helping to make hearables the fastest growing wearable segment. Nuheara’s delivery of hearing assistance to millions of people via true wireless buds is truly disruptive.

Nuheara’s Australian-born co-founders, David Cannington and Justin Miller began working together in 2005 at Sensear, a Perth-based company founded by Miller that designs and manufactures smart industrial hearing protection devices. Their products were life-changing for men suffering age- and job-related hearing loss and they wondered if they could make a smaller version for consumer use.

In 2014, they began to formulate a business plan for Nuheara – short for “a new way to hear.” They had three goals: the solution had to wirelessly connect to smart devices and stream audio, it had to have plenty of battery power, and it had to enable augmented hearing with a focus on separating speech from other ambient noise to boost conversations. They

After developing monitoring technologies for the ICU, Dr. Mault began to focus on the care and monitoring of patients at home after leaving the hospital. He embarked on an entrepreneurial career, founding and leading a series of startups, as well as the medical divisions of both Microsoft and Qualcomm. The companies developed various remote health technologies including the first web-based applications for healthcare professionals to monitor patients using mobile devices, post-hospital discharge home health monitoring products, a consumer-controlled health record system, a cloud-based SaaS platform for care coordination and family caregiving. Two of these companies were developed with his wife, Denisa Ronzani, also a successful entrepreneur.

Dr. Mault founded BioIntelliSense in 2018 as the “grand finale” in his pursuit of a ubiquitous application of remote patient monitoring across medicine. By January 2020, Dr. Mault as CEO, his co-founder Dave Wang and the BioIntelliSense team announced the FDA clearance of the BioSticker, an on-body sensor that allows for effortless continuous monitoring of vital signs and actionable insights, delivered to clinicians from patients at home, allowing early detection of potential complications. In late 2020, BioIntelliSense launched the BioButton, a coin-sized, low-cost disposable medical grade device that continuously measures vital signs for up to 60 days. He also serves on CTA’s Executive Board.

“Since the turn of the century, digital health has held

needed a digital signal processing expert, and convinced former Sensear CTO Dr. Alan Davis to develop a new solution for the consumer market.

Within a year, Nuheara raised \$5 million from seed investors, a “reverse” listing on the Aussie stock exchange and \$1 million from a 2016 Indiegogo campaign. The company went from a wearable prototype in January 2016 to a production ready product that premiered at CES 2017.

Consumers loved the IQbuds but wanted more personalization so that the buds operated more like a hearing aid. Nuheara partnered with National Acoustics Laboratories in Sydney, a leading hearing research institution renowned for creating NAL-NL2, algorithms used by audiologists worldwide to calibrate high-end hearing aids. These calibration algorithms were embedded in the new buds, along with a new clinically validated hearing assessment to create Ear ID, the first true personalization in a consumer hearable device. IQbuds Boost with Ear ID launched at CES 2018 and went on sale in May 2018.

In 2019, the Nuheara team began redesigning its buds, developing its own Speech in Noise Control (SINC) technol-

ogy to enhance normal hearing and allow wearers to enjoy high fidelity music, conversations or silence. The resulting IQbuds2 Max with active noise cancellation debuted at CES 2020. IQbuds2 Max have won numerous global innovation awards, including a Time Magazine 2020 Best Invention. Along with its new IQstream TV for private IQbuds TV listening, Nuheara generated \$10.5 million in revenue in its last fiscal year, a 517% YOY leap.

The company is working on the next generation of IQbuds to create a revolutionary hearing aid in a true wireless bud, continuing Nuheara’s hearable trailblazing.

2021 STARTUP OF THE YEAR **ROYBI**

Being multilingual is a valuable professional skill in a globalized world. Most experts agree the prime second-language learning time is childhood. Understanding the importance of children learning non-native languages, Elnaz Sarraf created ROYBI, the world’s first and only AI-powered educational companion that tutors young children in languages.

Sarraf experienced the value of learning a second language

as a child. Born in Tehran, Iran, her father bought her a PC when she was five to learn English, when there were fewer than 10 in the entire country. She moved to the U.S. in 2007 to attend California State University. “Knowing English and American culture helped me adjust to the new country and excel in my studies,” Sarraf says. “I experienced firsthand how learning a different language early on in life can help reach your goals later in life.”

In 2013, Sarraf successfully co-launched iBaby, Wi-Fi smart video baby monitors sold in over 5,000 stores worldwide. “I wanted to make a bigger impact and education has always been close to my heart.” She decided to focus on technology and AI to help children learn languages, an idea she shared with former iBaby CTO and parent Ron Cheng.

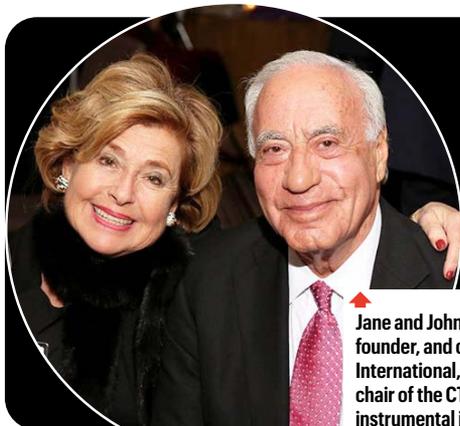
Over 18 months, they designed an interactive educational toy robot they dubbed ROYBI. The built in Automatic Speech Recognition Engine (ASR), developed for kids with privacy in mind, more than 3500 hours of machine training, and Edge AI (on-device recognition) allows ROYBI to interact with children even without internet connectivity.

ROYBI continuously analyzes children’s speech and vocabulary acquisition, learning each child’s unique communicative behaviors and skills. “We also wanted the experience of learning and interacting with ROYBI Robot to interest children in STEM topics,” Sarraf explains.

Sarraf and Cheng wanted a friendly gender-neutral robot to build trust, and the bundled collection of colored hats and accessories allow children to create a ROYBI unique to them. Only six-inches tall, a child can hold ROYBI in their hands and interact with it close-up.

After running out of cash twice, they reached out to investors, collecting more than 200 rejections. They convinced a factory to build a few prototypes and once they had samples to demonstrate their concept, they secured an initial \$4.2 million in funding.

ROYBI launched as an Indiegogo campaign in November 2019. Sarraf and Cheng were surprised when ROYBI, featuring more than 500 lessons in 70 categories and over 70,000 words in English and Chinese, was named a *Time Magazine* Best Invention. ROYBI launched in May 2020 and is sold in more than 130 retail outlets. ■



Jane and John Shalam. John Shalam, founder, and chairman of VOXX International, serves as the founding chair of the CTA Foundation and was instrumental in setting its mission.

INAUGURAL JOHN AND JANE SHALAM AWARD

To recognize the work being done to connect isolated seniors, the CTA Foundation has created the John and Jane Shalam Award to Combat Social Isolation. The winner this year is Selfhelp Community Services, the CTA Foundation’s first grant recipient in 2012. Selfhelp is dedicated to using technology to help improve the quality of life for older adults. Their “Virtual Senior Center” helps develop strong relationships among the participants and has gained the reputation of relieving the social isolation of disadvantaged older adults. With over 2000 participants and 28,000 live online classes, Selfhelp is truly making a difference.

2020



VICKI MAYO

2020 EXECUTIVE OF THE YEAR **Vicki Mayo**

When her four-year-old daughter was suffering from night terrors in 2015, Vicki Mayo called her friend, Dr. Amy Serin, a neuropsychologist. Dr. Serin was working on a technology to help people reduce stress and anxiety levels. Mayo's daughter tried Serin's solution the next night and fell asleep within 30 seconds, waking the next day refreshed.

Mayo believed that Serin's technology was too powerful to simply be a research study. In December 2016, the first TouchPoint Solution stress-reducing wrist wearable was launched. Mayo has since led TouchPoint Solution to more than \$2 million in annual sales and more than 75 accolades for the technology.

Raised in an entrepreneurial home, her father came from India with \$2 and now owns hotels across the U.S., assisted by Mayo's mother. She learned many lessons from her parents including, "The difference between ordinary and extraordinary is just a little 'extra'."

At 14, she built a computer system and established a travel agency, which she later sold for a profit. After graduating from Northern Arizona University in 2005, Mayo made a decision that changed her life. She adopted two boys she had found living alone in an apartment, abandoned by their parents. Two years later, she married Simer Mayo, then founded Mayo Hospitality Management, a management company focused on servicing

boutique hotels. In 2011, she sold the company and focused on their other companies — Valor Global and GMI.

After solving her daughter's night terrors, Mayo worked to create a consumer product. She built out algorithms and developed a wireless wearable design that used patent-pending technology, BLAST (bi-lateral alternating stimulation-tactile technology). The TouchPoints wearables emit vibrations that alter the body's stress-induced "fight or flight" response. Research showed that within 30 seconds, people experienced a 74% reduction in stress levels and a 68% reduction in stress-related body sensations. Triple blind placebo-controlled studies show that TouchPoints not only stabilize cortisol levels during stressful events, but reduce cortisol levels 20 minutes later when cortisol traditionally spikes.

The business remains totally self-funded and owned by Mayo. Within the first 30 days of availability in December 2016, the company piled up more than \$250,000 in sales. The product line now includes several TouchPoints wearables, including one for Calm and one for Sleep.

Mayo says, "From overcoming childhood adversity to learning to manage their anger and becoming more productive at work — TouchPoints have helped more than three million people across the world live better lives through neuroscience, including myself and my family."

2020 COMPANY OF THE YEAR **re:3D**

Throughout their travels volunteering for NASA's Engineers Without Borders (EWB), Samantha Snabes and Matthew Fiedler encountered sad scenes of abandoned gear and unused medical equipment, along with enormous piles of plastic waste. Over a beer in Rwanda, Snabes and Fiedler developed a novel idea: an affordable, large-scale 3D printer to enable someone to print solutions that used locally reclaimed plastic waste.

The result was the re:3D Gigabot, the world's largest, industrial FFF (fused filament fabrication) 3D printer, priced under \$9000. Snabes and Fiedler fulfilled their vision with the revolutionary Gigabot X FGF (fused granular fabrication), which prints from recycled local plastic waste — a breakthrough in affordable and ecologically responsible industrial printing.

Born in Detroit, Snabes dreamed of becoming an astronaut, earning diverse degrees and an MBA in supply chain management. She helped build an artificial immune system under a DARPA grant, which led her to NASA. Fiedler was one of 10 children raised on an Iowa farm. Trained as a machinist, he earned degrees in biomechanics and biomedical engineering, and became fascinated by 3D printing. They met while both were working in the Space Life Sciences Directorate and volunteering for EWB.



MATTHEW FIEDLER AND
SAMANTHA SNABES, re:3D



DAVE FERGUSON AND
JIAJUN ZHU, NURO

Snabes and Fiedler first presented their idea for a "toilet-sized 3D printer" as a finalist in a tech innovation competition. Next, the pair applied to Start-Up Chile, and were awarded \$40,000. Their company name reflected their dual objectives: 3D and "re," short for recycling, re-doing and re-envisioning. After unveiling a prototype at South By Southwest, they launched a Kickstarter campaign and met their funding goal in just 27 hours, raising \$250,000 in 60 days.

Several NASA compatriots pitched in, and re:3D shipped the first Gigabot in September 2013. The original Gigabot printed from hard-to-find and expensive filament. But Snabes realized that printing directly from ground up or pelletized plastic could be more affordable and accessible. The Gigabot X FGF, went on sale in 2019, and can print directly from cheaper and widely available recycled pellets or from easily ground or shredded local plastic waste.

re:3D expects a 15-20% YOY revenue rise in 2020. re:3D has generated more than \$8 million in sales in 50-plus countries. And re:3D donates one 3D printer to someone trying to make a difference in their community for every 100 units delivered. Snabes says, "In addition to providing a platform to explore sustainable closed-loops applications globally, multiple enterprises are using Gigabot X to create new

materials on demand or to benefit from printing faster and at a lower cost with pellets and flake."

2020 STARTUP OF THE YEAR

Nuro

A small vehicle resembling a white toaster on wheels rolls up to your home, you tap a code received by text on the vehicle's touchscreen. A contoured wing door rises to reveal the groceries you ordered. Removing your items, you tap "DONE" and the vehicle rolls off to its next stop. Oh, one thing. There's no one driving this futuristic vehicle.

The brainchild of Dave Ferguson and Jiajun Zhu, Nuro is a robotics company whose autonomous delivery fleet has made tens of thousands of "last mile" deliveries from local businesses to homes in Scottsdale, AZ and Houston, TX.

While pursuing a robotics degree at Carnegie Mellon University, Ferguson led the planning team that won the DARPA Urban Challenge in 2007, the leading competition for American autonomous vehicles sponsored by the U.S. Department of Defense. His PhD algorithms were then used for long-range autonomous navigation by various Mars Exploration Rovers.

When Ferguson joined Google's self-driving car project - now known as Waymo - he met Zhu, a principal software engineer who led the company's perception technologies

and large simulation systems teams. Ferguson was a principal engineer leading the computer vision and machine learning team.

Ferguson and Zhu discovered that 43% of the 220 billion vehicular trips Americans make each year are for errands, nearly twice the number of commuting trips. "We thought a lot about what is required for everyone to stop spending time running errands," Ferguson notes.

"We envision a future where everything comes to you, on-demand." Alleviating the time consumers spend on these "last mile" trips was the idea behind Nuro, founded in 2016, - a portmanteau of "new" and "robotics."

By January 2018, Nuro had raised \$92 million and premiered its first autonomous delivery vehicle, the R1. In August 2018, the company partnered with Kroger, the country's largest grocery retailer, to make autonomous deliveries in Scottsdale using Nuro's fleet of self-driving Priuses. After roughly a thousand deliveries at \$5.95 a trip, the service earned best-in-class customer satisfaction ratings. Nuro shifted operations to Houston in 2019. Nuro also has deals with CVS, Domino's and Walmart.

In 2020, Nuro introduced its second-generation vehicle, R2, which earned the first self-driving vehicle exemption approval from the U.S. Department of Transportation. The R2 adds more cargo space, a more durable body,

temperature control to keep deliveries fresh, and is meticulously designed to protect those outside the vehicle. For added safety, Nuro also deploys human operators who monitor the autonomous vehicles, and can take control at any time.

"We look forward together with others in the industry to ushering in new ways to provide transportation and safer streets for all Americans," adds Ferguson. ■

POLICY UPDATE

Autonomous Racecar Challenge at CES 2022

The Energy Systems Network, the organizer of the Indy Autonomous Challenge, will make history again and host a head-to-head, high-speed autonomous racecar passing competition at CES® 2022. The Autonomous Challenge @ CES, a first-of-its-kind for autonomous racing, will take place at the Las Vegas Motor Speedway on January 7.



The Indy Autonomous Challenge set records on Oct. 23, 2021, with the first high-speed autonomous racecar competition at the Indianapolis Motor Speedway. The Autonomous Challenge @ CES will feature several of the university teams that competed in Indianapolis, including the winner of the competition and the finalists.

A First for CES

“Autonomous racing is expanding the boundaries of tech and we’re thrilled to welcome the Indy Autonomous Challenge to CES,” said Gary Shapiro, president and CEO, CTA. “With automotive and transportation tech tracking for record growth at CES 2022, the Autonomous Challenge @ CES will

further show our attendees all that is possible with self-driving vehicle technology.”

The primary goal of this competition is to advance technology that can speed the commercialization of fully autonomous vehicles and deployments of advanced driver-assistance systems (ADAS). Designed by university teams, these enhancements will lead to increased safety and performance in motorsports as well as commercial transportation. The competition also is a platform for students to excel in Science, Technology, Engineering and Math (STEM) and inspire the next generation of innovators.

“Our university teams have proven that they can advance autonomous technology by setting world records with high-speed

laps and now on the biggest technology stage at CES 2022, they will take it to the next level with a head-to-head passing competition,” said Paul Mitchell, president and CEO, Energy Systems Network. “The Consumer Technology Association and CES 2022 play a central role in advancing and showcasing autonomous technology worldwide, so we can’t think of a better partner for this next step of the competition.” ■

TEAMS COMPETING IN VEGAS @ CES 2022

EuroRacing: University of Modena and Reggio Emilia (Italy), University of Pisa (Italy), ETH Zürich (Switzerland), Polish Academy of Sciences (Poland): **Oct. 23 finalist**

KAIST: Korea Advanced Institute of Science and Technology (South Korea)

MIT-PITT-RW: Massachusetts Institute of Technology, University of Pittsburgh, Rochester Institute of Technology, University of Waterloo (Canada)

PoliMOVE: Politecnico di Milano (Italy), University of Alabama: **Oct. 23 finalist**

TUM Autonomous Motorsport: Technische Universität München (Germany): **Oct. 23 winner**

Technische Universität München (TUM) team.



Join us at the Autonomous Challenge @ CES, at the Las Vegas Motor Speedway on January 7.



Courtesy of IAC; courtesy Spark

DIVERSITY & INCLUSION

CTA's Inaugural Diversity and Inclusion Study

This year, CTA embarked on its first-ever diversity and inclusion study, *Diversity and Inclusion: Driving Sustainable Change in the Workplace*, to gain insights on the technology industry's efforts incorporating diversity and inclusion initiatives into their business models. We assessed diversity and inclusion in the workplace, strategic priorities and measurement, and the challenges the technology industry faces in implementing changes.

One thing is certain — advancing diversity and inclusion is key to driving business forward.

Our research shows that diversity and inclusion in the workplace is highly important to our members and that it drives employee productivity, performance, engagement, fosters creativity and innovation, and positively impacts recruiting and retention of employees. CTA members surveyed for this study universally stated that diversity and inclusion is a priority for their organizations and an important factor in driving innovation and overall success.

Organizations are placing a heavy focus on recruitment, training and employee development initiatives to increase representation among historically underrepresented groups, including racial/ethnic minorities, women, acknowledged LGBTQ+, individuals with disabilities, veterans, individuals over age 50, and religious minorities. In fact, 80% of people surveyed are systemically

widening recruitment pools to tap new sources of talent, while 78% are providing employee development and training to improve the potential advancement of underrepresented people.

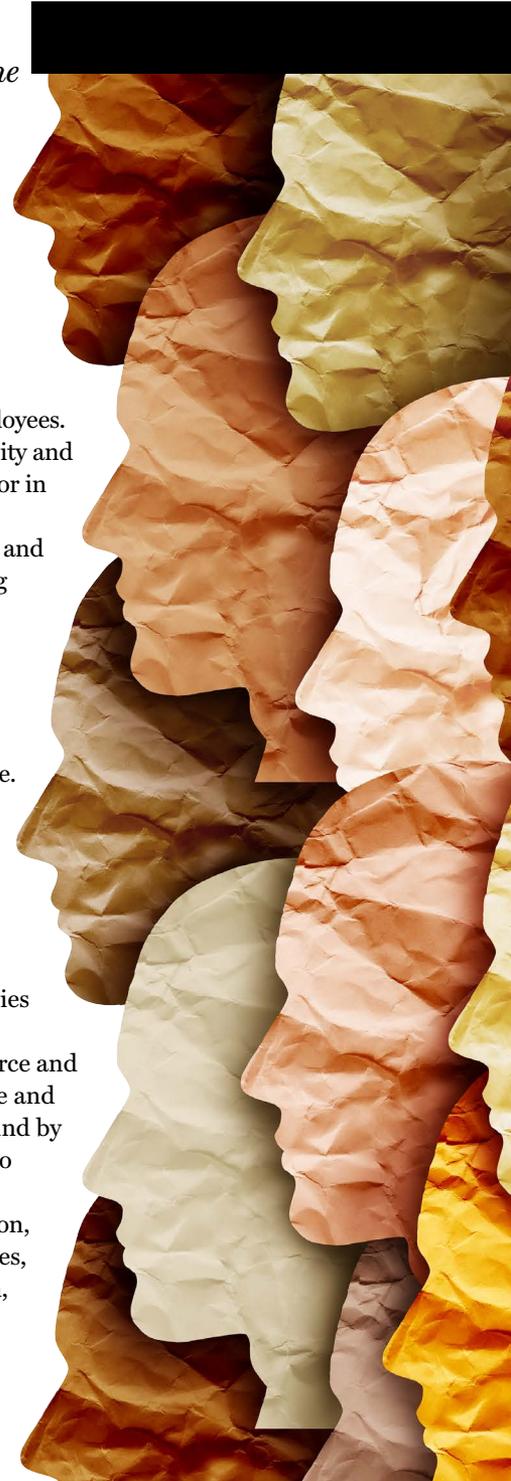
Just the Beginning

Accountability is being measured through employee feedback and companies' own internal data. While most organizations (45% of those surveyed) indicate their company is on-track to meeting their diversity and inclusion goals, leaders recognize there is still a lot of work to be done and that driving change is challenging and takes time.

While each organization has their own unique challenges, 61% of CTA member companies agreed that employee development was the easiest activity to change, followed closely by recruitment initiatives (55%). However, leaders expressed concern about potential workforce and hiring challenges. As we move into post-pandemic times, work flexibility, including remote and hybrid options, are effective alternatives and suggest that recruitment isn't necessarily bound by geographical boundaries. One thing is certain — advancing diversity and inclusion is key to driving business forward.

The research study shows that diversity and inclusion initiatives directly impact innovation, creativity, and productivity. To create greater access and mobility for underrepresented voices, CTA is investing \$10 million in venture firms and funds investing in startups led by women, people of color and other underrepresented populations. Additionally, our [Diversity and Inclusion Working Group](#) is a platform for member companies to share best practices, address challenges and develop strategies to create a diverse and inclusive tech ecosystem. This study is a direct result of the Diversity and Inclusion Working Group's key initiatives. We encourage you to read and spend time digesting the findings in our inaugural study. ■

GO ONLINE: CTA's *Diversity and Inclusion: Driving Sustainable Change in the Workplace* is now available to download.



POLICY TRENDS

Key Trends for the Future of Work

Each year CTA surveys its members on current and future workforce issues.

C TA's *5th Annual Future of Work* study revealed three key trends that will impact the workplace going forward.

Flexible Work Options

Even before the COVID-19 pandemic, CTA members were reporting that flexible work is key. Whether it's allowing for designated telework days, conducting remote interviews or providing stipends for work from home equipment, hybrid work is now part of the long-term strategy for 80% of companies.

In 2021, 92% of respondents said providing flexible work arrangements as a benefit is important for retaining employees. This percentage has steadily increased since 2017 when 74% reported as such.

"The post-COVID workplace means an entirely new set of rules for engagement," says David Lewis, CEO, OperationsInc. "Employers who pay close attention to the new norms will be best positioned to attract and retain talent. The biggest change is around how many employees want the ability to work from home some or all the time. If the role can be successfully performed remotely then employees expect to have that option. If employers insist on their in-office presence for work all or most of the time, the data suggests that you will see more of your valued team heading elsewhere."

Employer Provided Training

Gone are the days that tech employers can expect to hire a candidate who possesses every desired skill. Eighty-three percent of employers said they will need more employees with technical skills. With this steady demand for tech

workers we've seen over the past five years, employers are investing more in employee training. Almost one-third of companies are looking to apprenticeships to find qualified candidates, a number that has been on an upward trend. Forty-four percent said that tuition reimbursement is important for retaining employees in the next five years — an eight-point increase since 2017.

Amazon, which has been a leader in upskilling and training programs, explains why these are important benefits to provide. "The past 18 months have made it clear to Amazon that skills training and education are important to our employees," says Ardine Williams, Amazon vice president of Workforce Development. "Since the pandemic began, we've seen a surge in applications to our upskilling programs, reflecting employees' interest in bolstering their skills and future-proofing their careers. We are now offering more choice when it comes to education and skills training opportunities funded by Amazon — which includes funding for bachelor's degrees, GEDs and ESL proficiency certifications all of which are foundational for building career success at Amazon or beyond."

New D&I Leadership

We are seeing more companies that have diversity and inclusion staff in various roles. In 2021, 42% of companies reported a D&I team — a number that has steadily increased. More, 36% of companies now

Hybrid work is now part of the long-term strategy for 80% of companies.

have staff responsible for diverse hiring, a six-point increase from 2020.

Joseph Matthews, vice president, purchasing and diversity officer, Gentex Corp., shared insights into his evolving D&I leadership role. "I am directly responsible for diversity and inclusion. However, in that side of the organization, I'm a person of one and I report directly to the CEO. I have the responsibility for the strategy, but I leverage a lot of different organizations for the execution. Leveraging different organizations (i.e. functions) within the company who are striving to activate Gentex's DEI vision multiplies the impact. It allows initiatives to grow and flourish with creative solutions, and informative and engaging communications and educational programs."

While the COVID-19 pandemic accelerated many workforce trends, it's clear that flexible work, employee development and D&I leadership are three areas that are increasingly important for employers to be successful and keep up with the future of work. ■



To learn more, download CTA's *5th Annual Future of Work* study and join us at CES 2022.

SUSTAINABLE TECH

Pandemic Living, Powered by Consumer Technology

Pandemic life in 2020 was powered by consumer electronics.

When the COVID-19 pandemic was declared in 2020, Americans turned to consumer tech products to stay informed, connected and entertained.

In CTA's recent study titled *Energy Consumption of Consumer Electronics in U.S. Homes in 2020*, the authors at Fraunhofer USA found the estimated number of consumer electronics devices in homes today is 400 million more than a decade ago, yet less total energy is used to power them all — 17 TWh less energy to be exact. This highlights the industry's commitment to energy efficiency. The 2020 study is the first to examine consumer tech product energy usage during a global pandemic, but in addition to providing comfort, productivity and information, consumer tech products also remain an energy bargain.

Energy Consumption of CT in Homes

CTA commissioned the study to quantify the electricity consumption of consumer electronics (CE) in U.S. households. Devices analyzed include traditional consumer electronics, such as televisions and computers, as well as newer connected devices such as smart speakers.

Powering tech devices cost on average about \$191 per U.S. household last year — a bargain when you reflect on the many voids tech filled. America's consumer tech product energy use last year was up 24% from 2017. Specifically, the study estimates 3.3 billion tech devices consumed about 176 TWh in 2020, equal to some 12% of the residential sector and 4.5% of total electricity consumption. The spike in energy usage was driven by a big jump in product use during the pandemic. However, even at a product level, the

average annual cost in electricity to operate consumer tech is about \$9 a year for a laptop computer, about \$24 a year for a TV, and about \$3 a year for a smart speaker.



Prior to 2020, total energy used by consumer tech products had been declining, as seen in the 2013 and 2017 studies — demonstrating these devices are more energy efficient even as the number of devices has increased. Industry efforts to make tech products more energy efficient, including initiatives targeting television set-top boxes and internet equipment, have saved consumers billions in energy costs and avoided millions in CO2 emissions.

The energy use study confirms that Americans viewed TV as a pandemic salve. Daily TV usage was 5.8 hours in 2020, nearly 50% higher than in 2017. If not for the major boost in usage, annual energy consumption estimates likely would have remained relatively stable.

The average annual cost in electricity to operate consumer tech is about \$9 a year for a laptop computer, about \$24 a year for a TV, and about \$3 a year for a smart speaker.

With non-essential travel out of the question during 2020, in-person dining and other mainstay amusements canceled, and the isolation of stay-at-home orders, tech companies did what tech does best — innovate. Empowered with additional tech products and services, businesses and organizations offered virtual tours and travel experiences to afford homebound Americans a bit of escapism. Businesses deployed contactless payment systems, hospitals used telehealth systems to sustain primary care and school districts pivoted to online learning.

Innovation in Tech

CTA routinely re-examines energy usage to inform and lead initiatives related to energy efficiency and environmental sustainability. Indeed, the 2020 usage study covered products not around or prevalent for previous iterations — digital media streaming devices, smart home security cameras, robot vacuums, virtual reality headsets, and smart speakers — making an apples-to-apples comparison to earlier usage studies challenging.

Also, the use of consumer tech saves energy and reduces carbon emissions in other areas of life like home energy management and teleworking. As the country digs out from the pandemic, people have discovered new ways to receive goods and services, entertain themselves, access medical care, and stay in touch with their communities, family and friends. Time will tell which practices stay in place, but the industry will continue to innovate, empowering us to adapt to whatever lies ahead. ■

TECH TACTICS

The Rise of Cloud Computing

A staggering 81% of firms have accelerated their move to the cloud as a result of the pandemic, according to a Devo Technology study.

The rise of cloud is dramatically disrupting the on-premises (on-prem) IT data center providers.

Over the past decade, the average annual growth for data center spending was 2% while for cloud services (IaaS, PaaS and hosted private cloud) it was 52% notes Synergy. Data center spending is now in decline.

The cloud market grew faster in 2020 than in 2019, despite the steepest economic contraction in modern history. The reason is increased demand fueled by pandemic driven lockdowns and employees working from home, notes Deloitte.

The Unthinkable

At the outbreak of COVID-19 in March of 2020, many people believed the impact of the pandemic would only last for two weeks. And then it was two months. Now we're coming up to two years and with the Delta variant that is very contagious and with the threat of emerging new variants — what if we never get out of this cycle? Imagine that COVID-19

becomes seasonal like the flu where each year we're encouraged to get vaccinated against the latest variant strain.

Now that employees are used to working from home, will we move away from this trend? Dell doesn't think so. It has 165,000 employees and expects that 50% of its staff will never work in the office again. They may come in once a month for a meeting, but will not be in the office full time.

Cloud Predicted Growth

IT spending on cloud providers at the start of 2021 was predicted to rise by 30% according to Deloitte, but the growth has exceeded expectations for the first half of the year. Global growth of the cloud could hit 33% for 2021, according to Duncan Stewart, director of research for Deloitte who forecasts global tech predictions. An April 2020 survey of 50 CIOs found that respondents expected to see the proportion of total workload done on-prem drop from 59% in 2019 to 38% in 2021.

Because of this, enterprise resource planning vendors are encouraging clients to go to the cloud notes Stewart and that will continue.

Complacency Kills

In 2016, I was leading a strategic planning exercise with an executive team at one of the largest IT consulting firms globally with \$10 billion a year in sales. In preparing for the event, the president said he was excited with 8% projected growth for the following year and believed the business plan didn't need tweaking.

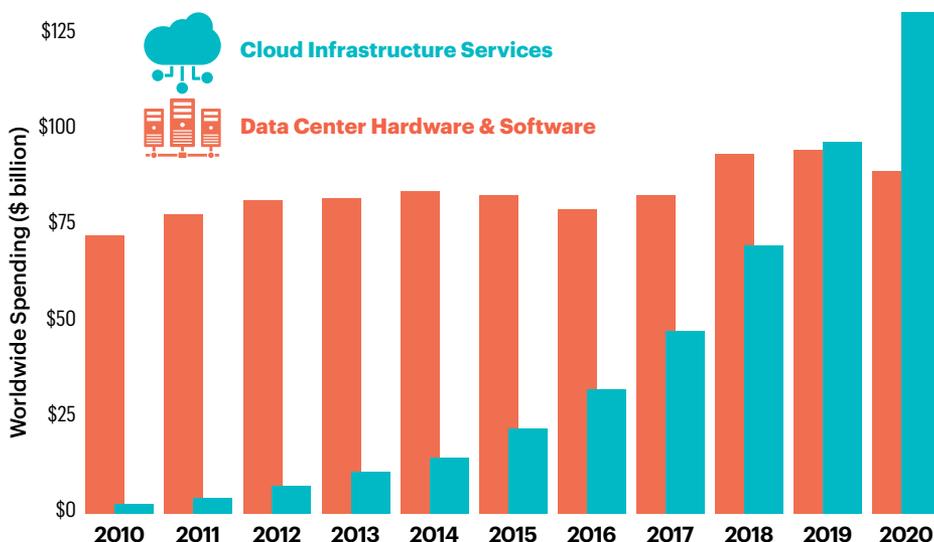
I began my session highlighting the analysts' consensus, at the time, was the cloud would experience 75% compounded annual growth rate (CAGR) for the next five years. My question to shake the executive team out of complacency was "How does 8% on-prem growth look now, compared to the predicted growth of cloud being almost 10 times faster?"

As an aside the actual CAGR from 2016 to 2020 has been only 42%. But 42% was still 5X the growth rate my client was happy with for on-prem.

Executives who are rooted in their existing business model have a tough time seeing other ways of working. How glaring do the signs have to be before leaders wedded to their current way of working recognize that the market has moved?

Once a trend is in place, a black swan event like the pandemic, can spell the end of an old way of working. In just one decade, the cloud has overtaken on-prem data centers. COVID spells the beginning of the end for the old, legacy business model of on-prem data centers. ■

ENTERPRISE SPENDING ON CLOUD AND DATA CENTERS



Source: Synergy Research Group

Jim Harris is the author of Blindsided. Follow him on Twitter @JimHarris.

C SPACE

NFTs Debut at CES 2022

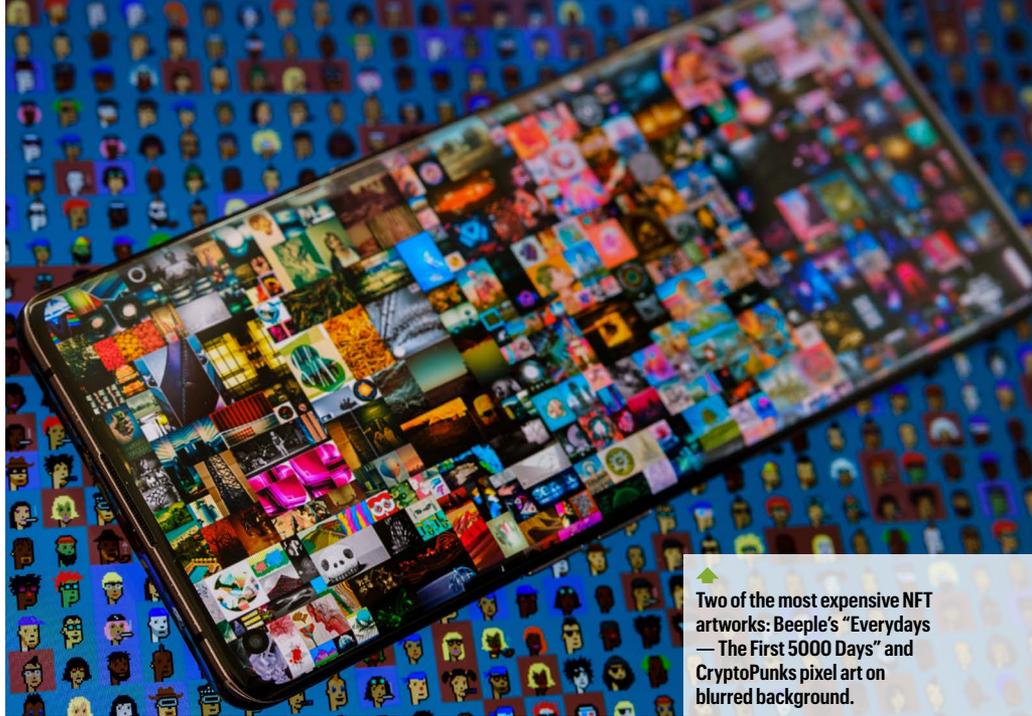
Non-Fungible Tokens (NFTs) have had an exhilarating ride in 2021.

NFTs will have a robust presence at CES 2022. In the months since the explosive \$69 million Christie's auction of the NFT "Everydays: The First 5000 Days" by Beeple (also known as Mike Winkelmann), the crypto world has seen:

- **Zero Contact**, an Anthony Hopkins movie, and the first NFT feature film to be released on Vuele. This viewing and distribution platform is for feature-length films and digital collectible entertainment content like NFTs. The sci-fi production will be auctioned as an NFT release (generating a few hundred thousand dollars) and then go into traditional theatrical and digital release.
- **The National Football League** (NFL), NFL Players Association and blockchain producer Dapper Labs, will create exclusive NFT highlight "Moments," digital video clips of "the best plays of the season."
- **The Bored Ape Yacht Club collection**, a set of 101 NFTs featuring images of cartoon apes, sold for \$24.4 million in an online sale.

Highlighting NFTs at CES

At CES 2022, NFTs will be part of the new digital assets exhibit and conference at C Space. Karen Chupka, EVP, CES, says that the conference sessions will "demystify the NFT market, explain how tech has disrupted the art market and highlight the latest creator currencies."



Two of the most expensive NFT artworks: Beeple's "Everydays — The First 5000 Days" and CryptoPunks pixel art on blurred background.

Phil Pyo, Netgear's vice president of product marketing, voices NFT enthusiasm shared by many exhibitors. "NFTs are here to stay," says Pyo, who also leads Netgear's "Meural Canvas" project, which includes NFT crypto-art display. "NFTs are natively digital," he adds, and intended to be "viewed and enjoyed digitally, including the evolving use of motion video and audio."

Netgear's core products for the NFT category are large digital frames in sizes up to 27-inches. It has bundled NFT graphics from Async, an NFT creator/distributor, offering about 100 images to view on the Meural Canvas II. Netgear sells a subscription option enabling customers to display images from a library of 30,000 art works, Pyo says. Async offers a programmable NFT feed for Meural customers.

Chris Snook, CEO of Arizona-based SDK Co, says his company's technology integration services focus on how "NFTs are becoming a large part of our 'culture' business." The SDK Co exhibit at C Space will include NFTs it has developed for Authentic Brands Group LLC, a brand management company that creates storytelling and immersive experiences for more than 30 brands in entertainment, sports and lifestyle. These include Elvis, Marilyn and Shaq plus fashion, luxe and active outdoor offerings.

"NFTs enable the containerization of everything, physical or digital," says Snook. He envisions extensive NFT opportunities for "tradeable collectibles,"

which could involve lending an NFT to a local museum or library. Snook adds, the NFT frenzy comes amidst a "chaotic period of pervasive computing." He believes NFTs will unlock "trillions of dollars" in the B2B blockchain community. His goal at CES is to introduce studios, entertainment companies, networks, blockchain and other tech companies to explore the NFT opportunities.

Becoming More Mainstream

Isabelle Kitz, co-founder of Atomic Form, a New York software and hardware NFT art market solutions company, foresees "wider institutional acceptance for NFTs of all kinds" in the coming year. "We'll see other industries begin to embrace tokenization in gaming, fashion, collectibles and much more." Kitz expects on-going crypto education will encourage artists and creators to see the benefits of NFT accessibility.

At CES 2022, the company will exhibit its 27-inch 4K LCD "Atomic Form Wave" that displays NFTs in a customizable way that lets customers "have full control over how their crypto art is displayed," Kitz explains. Its Atomic Form Photon enables users to display their NFTs on any screen.

Clearly, the lucrative wave for NFTs is just beginning. ■



At CES 2022, NFTs will be part of the new digital assets exhibit and conference at C Space.

FORWARD STRATEGIES

Why Cryptocurrency Makes Business Sense

Consumer technology leaders cannot afford to ignore the cryptocurrency space in the years ahead.

Online cryptocurrency exchange Coinbase's 56 million users traded over \$335 billion in virtual currency in Q1 2021. Visa reports that over \$1 billion was spent on crypto-linked credit cards in the first half of this year. Noting the field's skyrocketing potential, and nascent form, opportunities abound for businesses.

It's helpful for businesses to accept cryptocurrency as a payment method, given its growing acceptance among global customers — especially given these payment options' ability to increase audience spend and reach. Likewise, with use of mobile wallets now exceeding cash payments according to *FIS' 2021 Global Payments Report*, and credit cards supporting peer-to-peer transactions and virtual currencies, it's more of an imperative for companies to stay competitive.

Cryptocurrency also offers customers lower processing fees, and more opportunities to transfer money faster worldwide. Because of its ability to operate beyond borders, popular forms of crypto effectively offer shoppers (and the businesses who serve them) an

easily-implemented suite of globally-recognized payment solutions.

Cryptocurrencies will command a fast-growing share of the e-global commerce market going forward. That means soon businesses must accept these solutions or risk letting competitors take the lead. What's more, noting that availability, convenience, and value are now the strongest drivers of customers' purchase intent, failing to add support for cryptocurrencies could be a risky gamble, especially with use of digital wallet-based transactions projected to account for more than half of all eCommerce payments worldwide by 2024.

Getting in on the Crypto Craze

Consumers like cryptocurrency because it represents a direct exchange of value between individuals, and because virtual currencies and exchange rates aren't controlled by governments or central banks. Each transaction is also recorded on secure digital ledgering software (the blockchain) that's encrypted, spread across multiple computers, and hard to replicate, serving as an effective deterrent to virtual fraudsters. Even if it's just to incorporate support for cryptocurrency-based payments into your sales channel, businesses won't be able to avoid eventually jumping on the bandwagon. Whether

Consumers like cryptocurrency because it represents a direct exchange of value between individuals.

this trend truly holds the potential to move the needle for your business will largely come down to the following factors:

- Is there growing interest among your company's customer base in adopting cryptocurrency payments?
- What compelling business cases can you make, and inherent strategic value can you recognize, by new ventures in this space?
- From added promotional opportunities to more frictionless transactions, how can cryptocurrency solutions expand your business to reach new markets or audiences?
- How can you incorporate these tech tools throughout marketing, advertising and sales efforts in ways that can boost the bottom line?

Mind you, cryptocurrency-based exchanges still represent just a fraction of all digital payments. But it's also becoming clear that consumer technology leaders cannot afford to ignore the cryptocurrency space in the years ahead. Bearing this mind, it only makes sense to start experimenting now.

Remember you don't have to overspend or overinvest in R&D — sometimes, mixing and matching preexisting solutions in new or novel ways is the most cost-effective way to innovate. But it's also apparent that cryptocurrencies are here to stay — and you'll need to make investments in them to invest in your company's future. ■

Contact professional speaker Scott Steinberg at FuturistsSpeakers.com.

 **INDUSTRY EXPERTS** will discuss the evolving cryptocurrency landscape at CES 2022.



BY THE NUMBERS

Tech for the Holidays

What tech products will be at the top of wish lists?

CTA's *28th Annual Consumer Technology Holiday Purchase Patterns* report, released in late fall, highlights many consumer technology products that could be flying off the shelves during the holiday shopping season. With October-December typically accounting for 20% to 25% of yearly revenues, sales during the holidays are vital for the technology industry.

According to CTA's report, we expect the 2021 holiday season to be similar in terms of revenues to the 2020 period. We attribute this lack of growth to the supply chain disruptions that have limited retailers' ability to keep up with demand.

5G and Foldable Smartphones

This year CTA expects consumers to spend big on upgrades, most notably on purchasing the newest 5G smartphones. All the major manufacturers released new phones that operate on the 5G spectrum and wireless phone carriers are eager to switch as many customers as possible to the new technology. As a result, CTA estimates that 5G smartphones will sell over 159 million units in 2021, almost 70% of all smartphone sales this year.

To put that in perspective in 2020, 5G smartphones contributed to only 12% of all sales. In all, CTA expects 5G

smartphone sales to generate over \$72.5 billion in shipment revenues for 2021. Another feature gaining momentum in the smartphone industry are rollable or foldable phones. We estimate that rollable or foldable smartphones will generate \$3.8 billion in shipment revenues in 2021, an increase of 369% from 2020.

Top Tech

Another big-ticket item consumers plan to give during the holidays are laptops. Due to the pandemic and shift to more remote working and virtual education, the demand for laptops skyrocketed in 2020 and has carried over to 2021. Before the pandemic we estimated over 52 million laptops would be sold in 2021. Just a year later we estimate that over 75 million will be sold in 2021 generating revenue over \$44 billion. Despite shipping concerns, demand this high cannot continue and we predict a return to earth

in 2022 as only 68 million units will be shipped in 2022, a decrease of 10%.

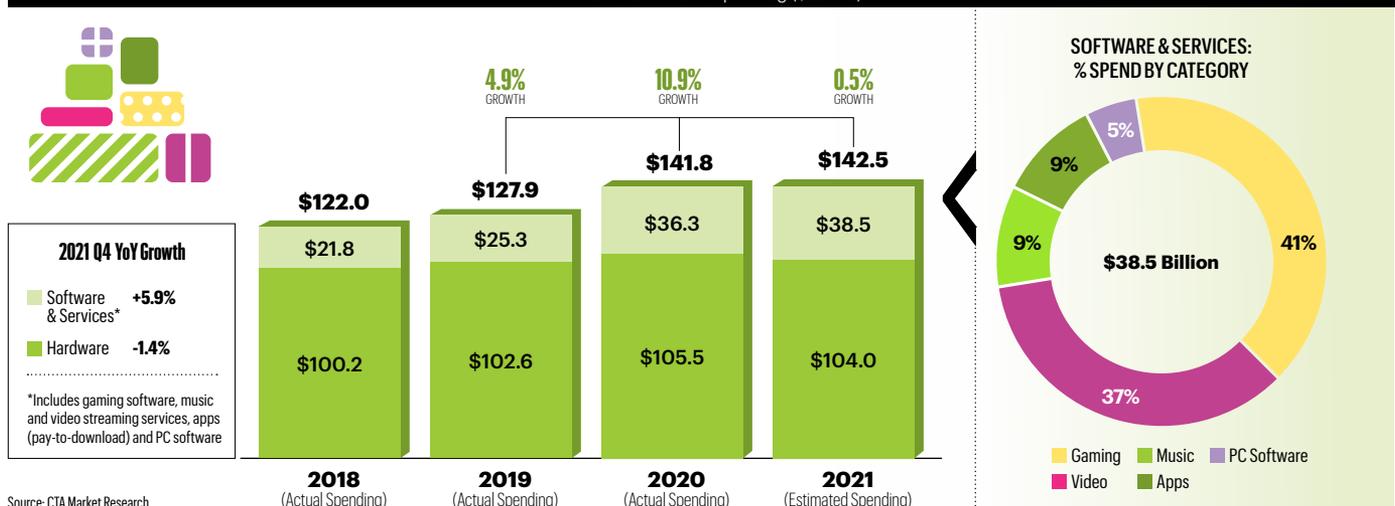
The "new" next-gen consoles that were released last year are still battling various market disruptions which have caused demand to stay at an all-time high as gamers continue to wait for the opportunity to buy new consoles. Despite the shipping concerns, CTA estimates that unit shipment volumes for home gaming consoles will see moderate growth in 2021 and at 7% in 2022. CTA forecasts that home gaming consoles will generate over \$5 billion in shipment revenues in 2021 an increase of 20% compared to 2020. Gaming software also tops gift lists this year and consumers are expected to spend over \$47 billion on gaming software products in 2021.

Another huge assortment of products that consumers are predicted to spend on this holiday are wearable technologies such as fitness trackers, smartwatches and connected exercise equipment. CTA estimates these products will generate almost \$13 billion in shipment revenues for 2021, which would be a 12% increase from 2020. This industry is still growing, and we project that by 2025 it will generate over \$16.3 billion in shipment revenues.

With the supply constraints still impacting the industry many are unsure how it will affect sales during the holiday. However, from a demand standpoint, the industry could not have a brighter future. ■

U.S. HOLIDAY TECHNOLOGY SPENDING FORECAST

October-December Spending (\$ Billion)



Source: CTA Market Research

CT REPORTS

The CTA Foundation Recognizes Innovation at CES 2022

Eureka Park Accessibility Contest Winners

The CTA Foundation's Eureka Park Accessibility contest winners will be at CES 2022. U.S.-based startups submitted their innovative technologies that highlight how tech enhances the lives of older adults and people with disabilities during the nomination period. The judges selected five startups to receive a complementary booth at CES 2022 in Eureka Park, along with a \$2,500 prize.



1. CAREGIVER SMART SOLUTIONS



**COSMOS
ROBOTICS**

2. COSMOS ROBOTICS INC.



**3. GALLAUDET UNIVERSITY
UNIVERSAL ACCESS ONLINE
CAPTIONING**



PEAR SUITE

4. PEAR SUITE



5. PERSONAL AI

GO ONLINE: For more information on the [winners](#).

Accessibility Tech

Accessible technology is featured across CES. Whether the focus is on smart cities, vehicle tech, smart homes or health and wellness — accessibility and usability play a major part in these innovations. One particular spot to highlight this tech is the Accessibility Marketplace, located in the LVCC. Accessibility tech enables users to live, work and play independently. Some traditional assistive technologies include screen readers, eye gaze controllers and hearing aids, but those are just a few of the many technologies at CES 2022.

CTA Foundation Pitch Contest

The CTA Foundation Pitch Competition, sponsored by AARP Innovation Labs, returns to the startup stage at CES on Thursday, January 6 from 1–3:00 PM. Located in Eureka Park, startups that previously entered will pitch onsite to the judges and audience, tech solutions that help adults and people with disabilities with an emphasis on smart home technologies. The winner will receive:

- Recognition and interview opportunities with the CTA Foundation network
- Be considered for the AARP Innovation Labs 2022 Grand Pitch Finale
- The opportunity to receive coaching and mentoring from AARP Innovation Labs Leadership
- Meeting opportunities with CTA Foundation Executives and Trustees

John and Jane Shalam Award Winner

The CTA Foundation announced the John and Jane Shalam Award to Combat Social Isolation earlier this year to recognize the efforts being made to use technology to combat social isolation. Non-profit organizations, companies, universities and individuals who are creating and implementing innovative products or programs that use tech to combat social isolation for older adults and people with disabilities were eligible to be nominated.

The winner of the first John and Jane Shalam Award is Selfhelp Community Services.



Selfhelp Community Services has a history with the CTA Foundation being its first grant recipient in 2012. Selfhelp is located in New York and is dedicated to helping older adults age with independence and dignity. They have done great work within the nonprofit community using technology to help improve the quality of life for older adults. Their face-to-face virtual community called "Virtual Senior Center", is designed to help address the problem of social isolation for homebound older adults. These virtual communities help develop strong relationships among the participants and have gained the reputation of relieving the social isolation of disadvantaged older adults. They also provide an engaging online program with face-to-face classes, discussion groups and cultural experiences. With over 2000 participants and 28,000 live online classes, Selfhelp is truly making a difference.

Selfhelp was recognized at the Consumer Technology Hall of Fame dinner on November 11th at the Metropolitan Pavilion in New York.

The CTA Foundation would like to offer a warm thank you to the companies and organizations who have directly supported our mission this year:

For a full list of company and individual supporters, please visit our website. ■



Join the CTA Foundation at CES 2022.

The Consumer Technology Industry is Improving Lives



The Consumer Technology Association (CTA)[®] and our members are working to make a difference in accessible technology. CTA supports industry-driven solutions to ensure innovative technologies and services are accessible to consumers with disabilities.

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**Consumer Technology
Association**[™]

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Association**[™]
FOUNDATION

The CTA Foundation is enabling innovative nonprofits to improve the lives of seniors and people with disabilities throughout our communities.

CTAFoundation.tech

MARKET BEAT

The State of Home Theater

Many consumers now enjoy movies, TV programs and video games in a cinematic and increasingly immersive environment (popcorn optional).

Innovations like soundbars and smart TVs have simplified the home theater equation, but not all advances have stuck like the now defunct 3DTV. Today the home theater market offers a wide panorama of technologies to match the size of almost any room and budget. Streaming media has further democratized these home entertainment systems. Therefore, understanding the current state of this market is crucial to manufacturers and content producers alike.

Recent CTA consumer research sets a new benchmark for home theater, illustrating a variety of dynamics including ownership, usage behaviors and purchase intentions. CTA's *Home Theater Landscape* study released on November 5, defines home theater as a 50-inch TV or projector coupled with an audio speaker set-up capable of rendering surround sound. Based on this definition, the study found 22% of U.S. adults (over 26 million) purport owning a home theater.

Home theaters today are primarily TV-based — just 14% of home theaters feature a projector. Average screen sizes for home theater systems are impressive with TVs at 61-inches and projector screens at 103-inches.

Key to the Experience

The audio data tells us much more about these systems. Based on reported ownership of audio products, the analysis suggests projector-based home theaters are more likely to employ an audio/video receiver (AVR) connected to speakers for discrete audio channels, such as a 5.1 or 7.1 speaker configuration. Meanwhile, TV-based home theaters are more likely to feature various audio solutions including

Average screen sizes for home theater systems are impressive with TVs at 61-inches and projector screens at 103-inches.

soundbar and subwoofer combinations. In terms of location, 62% of U.S. home theaters are in the living room or den of the home. And somewhat obviously, movies top (94%) the list of content watched on home theater systems.

Video source components add another dimension to home theater systems and the research reveals a broad mix of devices in play. Today's home theaters boast an average of 2.7 connected devices with dedicated 'shiny disc' players — either DVD, Blu-Ray or 4K Blu-Ray — leading the pack. Roughly 40% of home theaters have video game consoles, streaming media devices, or cable/satellite boxes connected to them. And nearly one-third (32%) of home theaters have a laptop or desktop computer connected to them. These findings reaffirm the longevity of

physical media formats (e.g., DVDs) but also confirm the importance of streaming media to home theater owners.

Most (75%) home theater owners say audio and video are equally important to their home entertainment experience. However, video products account for the larger portion (57%) of spending. Elements such as picture quality, screen size and audio quality top the list of features important to home theater owners and prospective buyers alike. However, wireless connectivity is now an equally important consideration to support streaming content.

Stream It

But how are consumers accessing streaming content to enjoy in their home theaters? The research shows consumers tap multiple devices for this purpose. When asked what devices they use to stream content 'most of the time', 59% use apps on a smart TV, 56% use a connected device, and 26% stream from some other device (e.g., smartphone).

Given the omnipresence of media and the impact of stay-at-home culture during the pandemic, it is not surprising the research found a large market of prospective owners looking to buy into home theater. Some 13 million consumers plan to complete their home theater set-ups in the next year, involving a mix of video and audio upgrades. If content is king, small wonder so many consumers wish to build their own Camelot right at home. ■

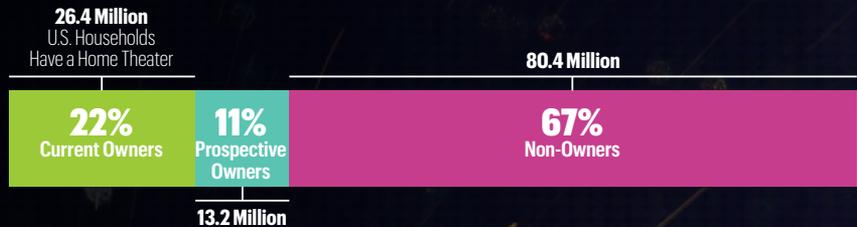


STATS AND FACTS

The Ultimate Immersive Experience

More than 26 million U.S. households have a home theater system, with the potential to grow by 50% in the next 12 months. On average, owners have nearly three extra devices connected to their home theater. DVD/Blu-ray players, video game consoles and digital streaming devices are starting to outpace cable/satellite boxes. Nearly half of owners use their home theater for virtual meetings for work and/or school, 93% did so for the first time during the pandemic. With many companies adopting permanent work-at-home policies, this use of home theater systems is likely to increase. ■

THE HOME THEATER MARKET

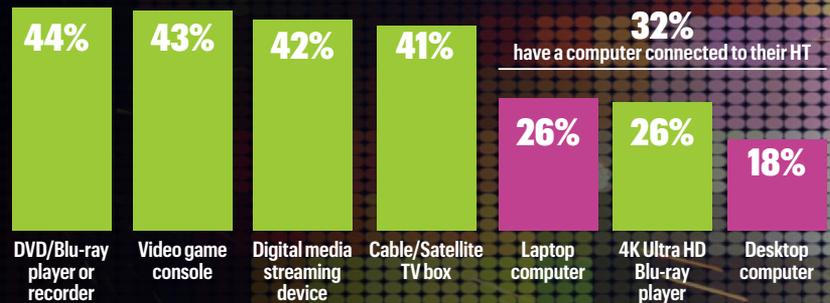


NOT ALL HOME THEATERS ARE EQUAL



PERIPHERAL DEVICES CONNECTED TO HOME THEATERS

Mean connected devices: 2.7



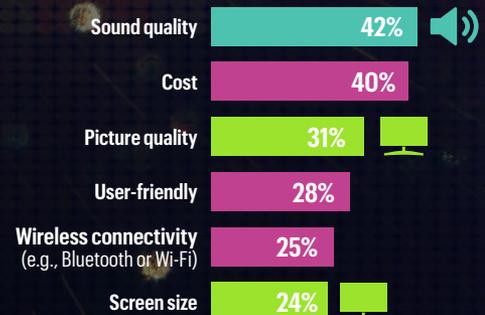
HOME THEATER AUDIO & VIDEO: ATTITUDES AMONG OWNERS

Importance of Audio & Video in Entertainment Experience



Top Considerations When Purchasing HT Components

Up to 5 selections allowed



Source: CTA Market Research

tomertu/Shutterstock

Health. NFTs.

Art Tech. Vehicle Tech.

Startups. 5G. Resilience.

Blockchain. **Beyond the everyday.**

Streaming. Entertainment & Content.

Autonomous Vehicles.

Smart Cities.

Amazing Previews. Chance Encounters. Inspiring Speakers. Momentous Connections.

We're excited to return to business so you can once again discover the latest technologies that will enrich our lives. Network with innovators, investors and media from around the globe, all while experiencing the magic of CES in-person or digitally.



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