Action Plan for the Integration and Development of Virtual Reality and Industrial Applications (2022-2026)

*Note: This is a translation by Emmie Hine, lightly edited by Jeffrey Ding. These are informal translations and all credit for the original work goes to the authors. Others are welcome to share **excerpts** from these translations as long as her original translation is cited. Commenters should be aware that the Google Doc is also publicly shareable by link. These translations are part of the ChinAI newsletter - weekly-updated library of translations from Chinese thinkers on AI-related issues: https://chinai.substack.com/*

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Virtual reality (including augmented reality and mixed reality) is an important direction in the frontier of the new generation of information technology and a major forward-looking field of the digital economy that will profoundly change the ways of production and life of humankind. A strategic window period for industrial development has already formed. This action plan is formulated in order to thoroughly implement the relevant deployments of the "Outline of the People's Republic of China 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035," enhance the core technological innovation capabilities of the nation's virtual reality industry, stimulate the innovation vitality of the industrial service system, accelerate the integrated development of virtual reality and industry applications, and build and improve the innovation and development ecology of the virtual reality industry.

1. Overall requirements

(1) Guiding ideology

Guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, we will fully implement the spirit of the 20th National Congress of the Communist Party of China, gain a foothold on the new development stage, fully, accurately, and comprehensively implement new development concepts, build new development patterns, and conform to the new round of the technological industrial revolution and the development trend of the digital economy. We will rely on a theme of high-quality development, take supply-side structural reform as the main line, improve the resilience of the industrial chain with breakthroughs in the core software and hardware of virtual reality, build a new system of ecological development with the integration and innovation of virtual reality industry applications, and use the new format of VR to promote new cultural and economic consumption. We will provide strong support for the construction of [China as] a manufacturing power, a digital power, a cultural power, and a digital China, and continuously meet the needs of the people for a better life.

(2) Development goals

By 2026, key breakthroughs will be made in the key technologies of three-dimensional, integrated virtual and real immersive audio and visual. A new generation of human-friendly virtual reality terminal products will be constantly enriched, and the industrial ecology will be further improved. Virtual reality will have achieved large-scale application in important economic and social industries. We will have formed a number of backbone enterprises and industrial clusters with strong international competitiveness and created an industrial development pattern in which technologies, products, services and applications flourish together.

Significantly enhance innovation ability: We will form the basis of a systematic innovation system with multi-technology integration and efficient collaboration between industry, academia, and research. We will have made important breakthroughs in core key technologies such as near-eye displays, rendering processing, perceptual interaction, network transmission, content production, compression encoding, and security and trustworthiness. We will research and formulate a VR standards system. We will build a manufacturing innovation center and build an experimental area for the broadcasting of television and online audio-visual virtual reality productions and an experimental area for the digital production of stage art empowered by virtual reality.

Continue to improve industrial ecology: The overall scale of the domestic virtual reality industry (including related hardware, software, applications, etc.) will exceed 350 billion yuan. The sales volume of virtual reality terminals will exceed 25 million units. We will cultivate 100 backbone enterprises with comparatively strong innovation ability and industry influence. We will create 10 concentration areas with regional influence and lead the development of virtual reality ecology. We will build 10 industrial public service platforms.

Clearly show the effects of integrated applications: We will achieve breakthroughs in key application fields of virtual reality such as industrial production, cultural tourism, integrated media, education and training, sports and health, business creativity, and smart cities. We will launch 10 types of virtual AV production application demonstrations and create 10 "virtual reality+" integrated application pilot cities and parks. We will form at least 20 characteristic application scenarios and 100 pioneering cases of integrated applications.

2. Key Tasks

(1) Promote integrated innovation of key technologies

Focusing on key subdivisions such as near-eye display, rendering processes, perceptual interaction, network transmission, content production, code compression, security and trustworthiness, we will optimize the "virtual reality+" endogenous capabilities. We will strengthen virtual reality and 5G, artificial intelligence, big data, cloud computing, blockchain, digital twins, and other new-generation information technologies, and superimpose the empowering abilities of "virtual reality+". We will promote the construction of a collaboration-capable cloud, network, edge, and terminal system. We will support the upstream and downstream collaboration of the industrial chain and the research and development of scenario-specific application technologies that have commercial potential.

Column 1: Key Technology Integration Innovation Projects

Near-eye display technology: We will focus on promoting the improvement of microdisplay technologies such as Fast-LCD, silicon-based OLED, and Micro LED. We will develop high-performance free-form surfaces, BirdBath optical modules, arrayed and diffractive optical waveguides, and other devices. We will carry out research and development in forward-looking fields such as vergence-accommodation conflict mitigation and light field displays. We will accelerate the development of near-eye displays towards high resolution, large field of view, and miniaturization.

Rendering technology: We will focus on advancing rendering optimization technology. We will research and develop emerging technologies such as hybrid cloud rendering, eye-tracking-based foveated rendering, and AI rendering. We will promote the development of virtual reality rendering processing in the direction of the refinement of software and hardware coupling, quality, and efficiency.

Sensory interaction technology: We will focus on promoting research on inside-out tracking and position technology. We will develop gesture tracking, eye tracking, expression tracking, full-body motion capture, immersive sound fields, and high-precision environmental detection and three-dimensional reconstruction technologies. We will strengthen the research on multi-channel interaction technologies such as myoelectric sensors, odor simulation, virtual movement, haptic feedback, and brain-computer interfaces. We will promote the development of perception interaction in the direction of naturalization, situationalization and intelligence.

Network transmission technology: We will promote the adaptation of 5G and gigabit broadband to virtual reality, and build full-scene real-time broadband communication capabilities. We will develop near-field ultra-wideband transmission technology between head-mounted display terminals and computing devices such as personal computers and mobile phones. We will explore the cloud-network edge-end computing power collaboration architecture for virtual reality services, and accelerate the research on end-to-end, refined, and differentiated network transmission operations and experience quality evaluation systems.

Content production technology: We will make breakthroughs in multi-modal data acquisition and generation technologies, and focus on the development of highly realistic three-dimensional modeling technologies such as for geometry, physics, physiology, and behavior. We will promote the research and development of key technologies such as 8K and above resolution, high dynamic range [HDR], wide color ranges, high frame rate panoramic shooting, high-performance splicing and stitching, multi-camera synchronization, and the hybrid production of virtual reality video and flat video. We will develop head tracking and sound field rotation technologies to enhance the sound experience of virtual reality programs. We will make breakthroughs in powerful interactive content production technologies such as six-degrees-of-freedom shooting, immersive audio, holographic video capture and production, rendering engines, and virtual avatars, as well as three-dimensional digital space experiences based on location services.

Compression encoding technology: We will focus on promoting perspective-based ultra-high resolution (8K and above) virtual reality video encoding and decoding technology. We will make breakthroughs in compression encoding technologies such as six-degrees-of-freedom virtual

reality video, spherical video, holographic video, immersive audio, and multi-modal data. We will research key technologies such as adaptive network transmission, and promote the development of virtual reality encoding and decoding in the direction of network intelligent collaboration.

Safe and reliable technology: We will focus on promoting the application of safe and reliable virtual reality products and services in various scenarios. We will make breakthroughs based on trusted computing in the active immunity dual system and action-based measurement techniques. We will accelerate the research and promotion of applications of trusted computing in virtual reality network application protocols and access mechanisms.

(2) Improve the supply capacity of the whole industry chain

We will comprehensively enhance the industrialized supply capacity of key virtual reality devices, terminal peripherals, business operation platforms, content production tools, and dedicated information infrastructure. We will research and develop dedicated processing chips for virtual reality, near-eye displays, and other key devices; promote the development of diversified terminal products such as integrated and split types; and improve the comfort, ease of use, and safety of terminal products. We will increase investment in the development of content production tools and improve the supply of high-quality content.

Column 2: Whole-Industry-Chain Supply Improvement Project

Key devices: We will focus on breakthroughs in high-performance, low-power dedicated VR processing chips. We will support 8k/60fps and above video decoding, high-performance graphics rendering, sensor integration, 3D reconstruction, and other functions. We will promote the large-scale mass production of new micro-display devices >4K; develop supporting display driver chips; and optimize the visual performance, volume, weight, and cost of optical devices such as free-form surfaces and optical waveguides.

Terminal peripherals: We will develop multi-form VR equipment such as integrated, split (rendering), vehicle-mounted, and cloud-based terminals. We will optimize for targets such as terminal size, battery life, heat dissipation, picture quality, and intelligent perception. We will research and develop audio-visual systems that can be seen with the naked eye and with immersive sound reproduction. We will research and develop 3D, real-time, multi-task VR operating systems. We will improve the ability of mobile phones to generate and display VR content. We will popularize VR products supporting sensory interaction.

Business operation platforms: We will develop offline experience centers such as immersive theme parks, theaters, and cultural venues. We will develop a cloud-based virtual reality online service platform and an augmented reality operations platform based on users' geographic location. We will promote the establishment of an efficient, high-quality, and safe virtual reality business operations platform and support new infrastructure to realize functions such as content aggregation, distribution, and payments.

Content production tools: We will develop key content production software such as three-dimensional scene editors, high-performance splicing and stitching, high-precision cloud-based real-time rendering processing, virtual reality video integration and broadcasting, and immersive audio production and editing. We will develop high-performance 3D

ultra-high-definition panoramic cameras, 3D scanners, motion capture peripheral devices, sound field microphones and other audio and video content collection equipment, and perspective-based virtual reality video and immersive audio content compression encoding equipment. We will develop content editing and transmission tools such as cloud computing resource pools, webcast platforms, and high-performance transmission networks.
Dedicated information infrastructure: To meet the special business needs of virtual reality such as video content, graphics rendering, and spatial computing, we will develop a multi-node computing power information infrastructure that integrates cloud computing, edge computing, and immersive computing to support virtual reality. We will realize efficient and secure collaboration between cloud and network edges and terminals.

(3) Accelerate the implementation of multi-industry and multi-scenario applications
Facing the development goals of large-scale and characteristic integrated applications, we will deepen the organic integration of virtual reality in industry fields and promote qualified industries to carry out large-scale application pilot projects.

(a) VR + industrial production

Focusing on key vertical industry areas, we will promote the deep integration of virtual reality and the industrial internet. We will support the popularization of applications of VR in key links of the product life cycle, such as design, manufacturing, operation and maintenance, and training. We will strengthen compatibility between the digital twin model and data. We will promote the integration and intelligence of the whole process of industrial production. We will support industrial enterprises and parks to use virtual reality technology to optimize production management and energy conservation and emissions reduction, so as to improve quality, increase efficiency and reduce costs. We will develop a virtual reality open service platform that supports multi-person collaboration and simulation, open up product design and manufacturing links, build a new solution for remote operation and maintenance that integrates the virtual and real, create a new model of employee skills training that adapts to various advanced manufacturing technologies, and accelerate the digital and intelligent transformation of industrial enterprises.

(b) VR + cultural tourism

We will promote the development of virtual reality digital experience products in cultural exhibition halls, tourist areas, and characteristic city blocks, so that excellent cultural and tourism resources can be "lived" with the help of virtual reality technology. We will launch innovative virtual reality applications such as pre-departure previews, virtual-real fusion navigation, tour guides, artwork exhibitions, and restoration of cultural relics and historic sites. We will encourage first- and second-level museums and qualified tourist activity venues to set up immersive experience facilities and equipment.

(c) VR + mixed media

We will promote virtual reality panoramic cameras, 3D scanners, sound field microphones, naked-eye immersive presentation and other equipment. We will explore new narrative direction and virtual shooting technologies in fields of integrated media content production such as news reports, sports events, film and television animation,

game social networking, and short videos. We will promote the simultaneous development of broadcast-level high-quality, popular and low-threshold virtual reality digital content, use virtual reality technology to facilitate the renewal of radio, television and network audio-visual formats, and support the construction of virtual reality audio and video zones and theaters, and explore new forms of interactive social networking based on virtual avatars and other new forms.

(d) VR + education and training

We will build a number of virtual reality classrooms, teaching and research offices, laboratories and virtual simulation training bases in primary and secondary schools, higher education, and vocational schools. For experimental and associative teaching content, we will develop a number of syllabus-based VR digital courses. We will intensify students' interactions with various virtual items, complex phenomena and abstract concepts, promote the upgrading of the teaching model to independent experiences, and create an immersive new classroom that supports independent inquiry and collaborative learning. We will serve the country with major national strategies, promote "virtual simulation experimental teaching 2.0," support the construction of a number of key projects for virtual simulation experiments and training, and accelerate the training of talents that are in short supply.

(e) VR + sports and health

We will focus on the development requirements of "big sports, big health," and promote the compatibility and adaptation of virtual reality terminals and content for sporting goods, sports facilities, and fitness software and platforms. We will support virtual reality entering multiple sports fields such as outdoor and indoor, aerobic and anaerobic, individual and group, and leisure and competitive, and promote the application of virtual reality in training and competition. We will create digital, intelligent, and immersive new sports solutions that combine online and offline, and build a new format for mass fitness. We will promote the application of virtual reality in scenarios such as medical education, clinical diagnosis and treatment, rehabilitation nursing, addiction withdrawal, psychological counseling, care visits, and surgical navigation.

(f) VR + business ideas

We will create and promote a number of use cases supported by VR technology in fields such as smart home decoration, virtual house inspections, large-scale exhibitions, fashion ideas, video conferencing, remote office, smart business circles, and takeaway retail. We will develop new modes of online and offline synchronous interaction and organic integrations of business activity experiences, and create new commercial scenarios and new businesses.

(g) VR + entertainment

We will build a normal virtual reality online studio, filming and broadcasting environment. We will support online performances of high-quality resources such as stage arts, variety shows, and intangible cultural heritage, and carry out promotional activities for immersive industry experiences. We will explore new methods of interaction between the audience and performance area, and original online performance content suitable for online viewing. We will create a "super scene" immersive experience that combines virtual and real. We will promote the application of virtual reality in the entertainment industry, enrich the content of virtual entertainment experiences, and improve the digital level and experience of offline entertainment.

(h) VR + safety in emergencies

We will carry out immersive virtual drills for scenarios such as mine safety, hazardous chemical safety, and natural disaster prevention and control and realize the transformation of safety emergency drills from "equipment-centered" to "user-experience-centered". We will promote the informatization and innovative construction of smart policing and emergency management, explore augmented reality smart individual systems, and realize the integration and linkage of all elements of comprehensive security information.

(i) VR + disability assistance

In scenarios such as travel assistance, skill training, spiritual care, cultural tourism and leisure, social communication, education and employment, and life shopping, we will explore putting into practice a group of applications of VR empowering disabled and vulnerable groups, promote a set of VR equipment adapted to disabled and vulnerable groups, and help the construction of “accessible information” services.

(j) VR + smart cities

We will explore the integration and application of virtual reality in urban governance to form urban visual management solutions. We will promote user location-based service (LBS) life assistant applications and high-precision visual positioning service (VPS). We will support centimeter-level spatial computing and multi-scenario large-scale real-time user interaction. We will improve the operation and service capabilities of digital space and explore three-dimensional commercial construction models of indoor and outdoor real scenes. We will create personalized smart life information services that integrate the virtual and real, the efficient and convenient, for scenarios such as transportation, catering and shopping, entertainment and leisure.

Column 3: Multi-scenario application integration and promotion projects

“VR/AR Industrial Empowerment” project in the industrial production field: We will accelerate pilot applications of virtual reality in vertical fields, promote the construction of intelligent workshops and virtual production lines based on virtual reality technology, and build a cross-domain and cross-link simulation and collaborative development environment. In industries including electronic information, equipment manufacturing, raw materials, and consumer goods, and key fields including energy and electricity, aerospace, rail transit, steel and petrochemical, construction engineering, we will cultivate no fewer than 50 representative application industrial scenarios including in development and design, manufacturing and assembly, operation and maintenance inspection, remote collaboration, marketing display, etc.

"VR/AR Immersive Tourism Experience" project in the cultural tourism field: We will support the application of virtual reality technology in the field of tourism, promote the development of interactive and immersive digital experience products in scenic spots, resort areas, and neighborhoods, and develop new tourism services such as immersive interactive experience, virtual displays, and smart guides. We will cultivate new formats such as cloud tourism, cloud live broadcast, and cloud exhibition, and launch a number of new scenarios for immersive tourism experiences.

"VR/AR Mass Fitness" project in the fields of sports and health: We will support the development of integrated sports and VR technology, launch a set of fitness and exercise VR products with the theme of being a sports power, and promote the pilot application of many representative application scenarios such as digital cycling and running. We will optimize effective adaptations of sports equipment, fitness software, and sports facilities to VR terminals. We will organize virtual reality sports and health promotion activities to enhance public awareness of virtual fitness.

“VR/AR Online Performance” project in the performing arts and entertainment fields: We will promote the large-scale commercial use of 5G virtual reality in the performing arts industry and build a normalized "virtual reality + performing arts" platform. We will support art troupes and performing arts institutions in holding online immersive performing arts activities; promote the online development of stage art; encourage art troupes, art workers, and inheritors of intangible cultural heritage to carry out immersive performances on virtual reality platforms; and cultivate a set of original online performance products that meet the needs of immersive entertainment and are suitable for online viewing, dissemination, and consumption. We will support the application of virtual reality in theme parks, park blocks, and commercial places, and develop immersive entertainment experience products.

“VR/AR Smart Business Districts” project in the smart city field: We will support augmented reality applications based on user geolocation services and high-precision visual positioning services to empower offline neighborhoods. We will select no fewer than 10 hotspot business districts and promote the construction of “holographic neighborhood” models that integrate virtual reality with immersion and digital space operation, and create personalized life information services covering interactive social networking, indoor navigation, catering and shopping, etc.

(4) Strengthen the construction of industrial public service platforms

Build a common application technology support platform: Focusing on common technologies in the industry, we will explore key technical needs in the industry, and rely on industry leading enterprises, colleges and universities, and scientific research institutes to build common technology platforms for the industry and carry out joint research on key technologies, provide services related to standards and intellectual property rights, solve technical bottlenecks that restrict the replication and promotion of industry applications, and improve the basic capabilities of cross-industry virtual reality applications.

Build an integrated development platform for immersive content: We will carry out research and training on immersive content production tools and process optimization; provide content developers with virtual reality shooting software and hardware toolboxes such as panoramic shooting, 3D reconstruction, live broadcast distribution, development engines, virtual avatars, immersive audio, and terminal peripherals; and support 3D, strong interactive content creation and large-scale production. We will support the construction of open source software communities for immersive content development, encourage openness to society, and support the production of user-generated content (UGC). We will encourage the creator economy and build high-quality content co-construction and sharing platforms.

Build a fusion application incubation platform: We will encourage qualified places and enterprises to build a number of virtual reality experience centers to focus on showcasing pioneering application scenarios. We will build a user experience evaluation environment covering multiple links in the industrial chain, and carry out the development and publicity of key virtual reality standards. We will construct service carriers such as incubators and makerspaces, and create a professional innovation and entrepreneurship service system covering the entire process.

(5) Build an integrated application standards system
We will strengthen the high-level design of standards, and build a virtual reality comprehensive standards system covering the entire industry chain, including general use, content production, network transmission, distribution platforms, terminal equipment, quality evaluation, and innovative applications. We will clarify the roadmap for the development of virtual reality standards according to the urgent needs of the industry. We will accelerate the formulation and promotion of key standards such as health and comfort, user information security, content production process, transfer encoding, and employee capabilities. We will promote research on virtual reality application standards, and formulate model architecture and solution standards for different application scenarios. We will encourage Chinese enterprises and institutions to participate in international standardization activities and actively contribute to Chinese technical solutions. We will support enterprises in implementing national standards such as the Data Management Capability Maturity Assessment Model (DCMM).

3. Assurance Measures
(1) Strengthen coordination and linkage
We will strengthen departmental coordination, formulate work implementation plans for each department on an annual basis, promote the timely implementation of various key tasks year by year, and conduct regular summarizations of work results. We will strengthen the linkage between ministries and provinces, guide places with industrial foundations to introduce industrial plans and supporting policies, and strengthen organization and implementation. We will encourage localities to build application supply and demand docking platforms, promote cooperation and exchanges between virtual reality companies and the industry application side, and accelerate the application of new technologies and products.

(2) Optimize the development environment
We will guide scientific research institutes, industry alliances, and industry associations to strengthen collaboration and establish public service platforms. We will coordinate the use of state-level funds, guide social capital investment, and promote the effective supply of industrial funds. We will promote the integrated development of large, medium, and small enterprises, and cultivate specialized, special and new small and medium-sized enterprises [SMEs], and specialized and new “little giant” enterprises. We will establish a safety system, strengthen the protection of personal and public information resources, and improve risk prevention for data abuse and privacy violations. We will guide the development of virtual reality products and services suitable for youth use.

(3) Deepen technology R&D
We will encourage increased investment in research and development of basic theories, key technologies, and application technologies related to virtual reality; support leading enterprises, universities, scientific research institutes, standards organizations, and industry alliances with technological advantages to establish multiple innovation carriers; and strengthen the supply of key core technologies and industrial common technologies. We will support R&D results to accelerate the iteration of key products and industry applications to maturity.

(4) Launch application pilots
Focusing on key application areas of virtual reality, we will organize application pilots, explore application scenarios with potential commercial value, have virtual reality fusion application case collection events, and create pioneering application cases that can be replicated and promoted. We will encourage telecom operators, Internet companies, etc. to participate in the construction of virtual reality content development centers and application experience display centers.

(5) Build industrial clusters
We will carry out the construction of virtual reality fusion application pilot cities and parks, and accelerate the cultivation of backbone enterprises with leading and driving roles. Combined with the construction of the national new industrialization industry demonstration bases, we will support the agglomeration and development of the virtual reality industry. We will build virtual reality manufacturing innovation centers to carry out technology and industrial services for application innovation. Combining local and industry characteristics, we will build a professional public service platform to promote the implementation and promotion of virtual reality technology and application solutions.

(6) Strengthen talent supports
We will support colleges and universities to strengthen the construction of virtual reality-related disciplines and majors, encourage industry-university-research cooperation, promote joint precision education of colleges and universities, scientific research institutions and enterprises, strengthen talent introduction, expand targeted training, and cultivate a group of compound talents. We will optimize the growth environment for entrepreneurs; establish a new mechanism that is conducive to entrepreneurs' participation in innovative decision-making, gathering innovative talents, and integrating innovative resources; and create a high-level leading talent team.

(7) Promote exchanges and cooperation
We will give full play to the role of alliances, associations, and other industry organizations in publicity and promotion, exhibitions, competitions, and meetings, and promote excellent application cases to “enter the park” and “enter the enterprise.” We will expand the channels of international exchange and cooperation in the field of virtual reality, and promote the interaction of resources such as technology, talents, and funds. Combined with the implementation of national strategies such as the Belt and Road Initiative, we will promote enterprises to establish overseas market service systems and accelerate the pace of international market development.