On behalf of the XR Association (XRA), thank you for the opportunity to provide input on the National Science Foundation (NSF) Directorate for Technology, Innovation and Partnerships (TIP) assessment of the ten congressionally mandated Key Technology Focus Areas. We commend the NSF for its ongoing commitment to prioritizing technologies that will drive U.S. competitiveness, economic growth, national security, and workforce development.

As one of the leading voices of the immersive technology industry, XRA urges NSF to **retain and strengthen the existing focus area on "advanced communications and immersive technology"**. Immersive technologies – including augmented, mixed, and virtual reality, as well as other emerging technologies that blend digital and physical environments such as certain wearables, digital twins and spatial computing – are rapidly evolving and are foundational to the future of work, manufacturing, defense readiness, education, and medical innovation.[1] This is especially true as we see AI and XR converging to create immersive, intelligent environments that adapt to users in real time, a trend that is transforming industries by enabling more personalized, engaging, and effective digital experiences. In order to remain competitive on the global stage, it is critical that immersive technologies remain a focus of federal research investments, especially given their cross-cutting potential and role in driving innovation across multiple sectors.

Q1-a: Are any of the current focus areas no longer critical?

No, all ten current focus areas remain vital. However, we strongly encourage NSF to continue naming immersive technologies explicitly to maintain clarity and momentum around a field that directly supports multiple national priorities.

Q1-b: Should any focus areas be revised or refined?

Yes. We recommend NSF refine and elevate immersive technology to its own category. As noted above, immersive technologies encompass a suite of technologies that blend physical and digital environments. In addition, the growing category of smart glasses and AR powered by artificial intelligence is expected to have a transformative effect on society. This expectation is based on several converging trends:

- Mainstream Adoption: Consumer demand for smart glasses has surged, with millions of units sold and projections indicating over 25 million AR glasses shipments by 2030. The market is expected to grow from $1.93 billion in 2024 to $8.26 billion by 2030.[2]
- Technological Breakthroughs: Lightweight, fashionable, and affordable devices are now available that blend seamlessly into daily life. Features include real-time translation, hands-free photography, proactive AI assistants, and contextual information overlays.
- Industry Investment: Major tech companies—Meta, Apple, Google, and others—are investing heavily, signaling that smart glasses are positioned to become a central consumer technology

Q2: Rank top three technologies against NSF's evaluation criteria

[1] Value creation in the metaverse | McKinsey

[2] https://www.brandxr.io/best-ai-glasses-of-2025

We rank immersive technology among the top three technologies under all five criteria. Here's how:

Evaluation Criterion	XR Relevance
Geopolitical competition	China's 5-year XR industrial strategy aims for over $50 billion in market value by 2026, establishing multiple R&D platforms to support XR adoption.[3] [4] South Korea's Immersive Economy Development Strategy targets a domestic economic impact of $23 billion by 2025.[5] The EU also launched a $10B+ initiative under its Strategic Technologies for Europe Platform (STEP) that includes immersive technologies.[6]
National and economic security	XR is central to military readiness. The U.S. Army's Integrated Visual Augmentation System (IVAS) provides soldiers with real-time situational awareness and synthetic training environments.[7] The U.S. Air Force is integrating XR to train pilots and operators in realistic adversary scenarios.[8] XR also enhances industrial security by enabling predictive maintenance and fault simulation in defense manufacturing.[9]
Workforce and talent pipeline	XR accelerates training in advanced manufacturing, healthcare, energy, and logistics. A recent PwC study found XR learners complete training 4x faster and retain 275% more information vs. traditional methods. XR reduces costs and expands access.[10]
Economic growth potential	The global XR market is projected to exceed **$1,625.48 billion by 2032**, with U.S.-based firms driving enterprise adoption in sectors like construction, defense, retail, and manufacturing. XR also catalyzes entrepreneurship and new job creation.[11]
Use-inspired and translational research	XR drives demand for interdisciplinary breakthroughs, in optics, haptics, edge computing, AI, semiconductors, accessibility, and human factors. XR is a prime use case for TIP's translational mission.[12] [13]

Conclusion

Immersive technologies are poised to revolutionize the way we interact with the world.[14] From strengthening domestic manufacturing and workforce training to advancing national defense, education, and medical innovation, their impact is both noticeable and expanding.

XRA appreciates NSF's continued recognition of immersive technology as a priority area. We encourage NSF to not only retain it explicitly among the Key Technology Focus Areas but elevate it to a free-standing category to reflect emerging intersections with spatial computing and AI and increase support for XR-related research across TIP programs.

We welcome continued engagement with NSF and stand ready to support efforts to advance the immersive technology ecosystem in alignment with U.S. strategic goals.

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[3] Five sector joint development: five-year action plan for integrated development of virtual reality (2022-2026)_数字经济专业委员会

[4] Reality Check: Why the U.S. Government Should Nurture XR Development - XR Association

[5] Press Releases - 과학기술정보통신부 >

[6] EUROPEAN INNOVATION COUNCIL AND SMES EXECUTIVE AGENCY - EU's strategic technology programme mobilises €10B in first year

[7] PEO Soldier | Portfolio - PM IVAS - Integrated Visual Augmentation System (IVAS)

[8] AFSOC embraces Extended Reality (XR) to enhance readiness > Air Force Special Operations Command > Article Display

[9] Top Integrations for XR in Aviation, Manufacturing, and Automotive Industries: A Focus on Maintenance | Mass Virtual®

[10] Immersive Learning Benefits: Reducing Training Time and Enhancing Skill Acquisition - XR Today

[11] Extended Reality [XR] Market Size, Share, Industry Report 2032

[12] The State of XR 2025: Mainstream Adoption and Industrial Impact — InnovateEnergy

[13] XR ASSOCIATION RELEASES "STATE OF THE INDUSTRY REPORT," WITH HIGHLIGHTS FROM 2024 AND A LOOK AHEAD TO 2025 - XR Association

[14] Immersive Technologies: Transforming The Future Of 2025