

Emerging Standardization Requirements for the Metaverse in Defense Use Cases

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What is the ViWISSO project: background

The ViWISSO Project is preparing a complete and exhaustive assessment of standardization activities in diverse virtual world technologies, collecting requirements from a wide range of experts and sources and, based on gaps between the current activities and future requirements, will propose actions and recommendations designed to accelerate development and adoption of standards for virtual worlds.

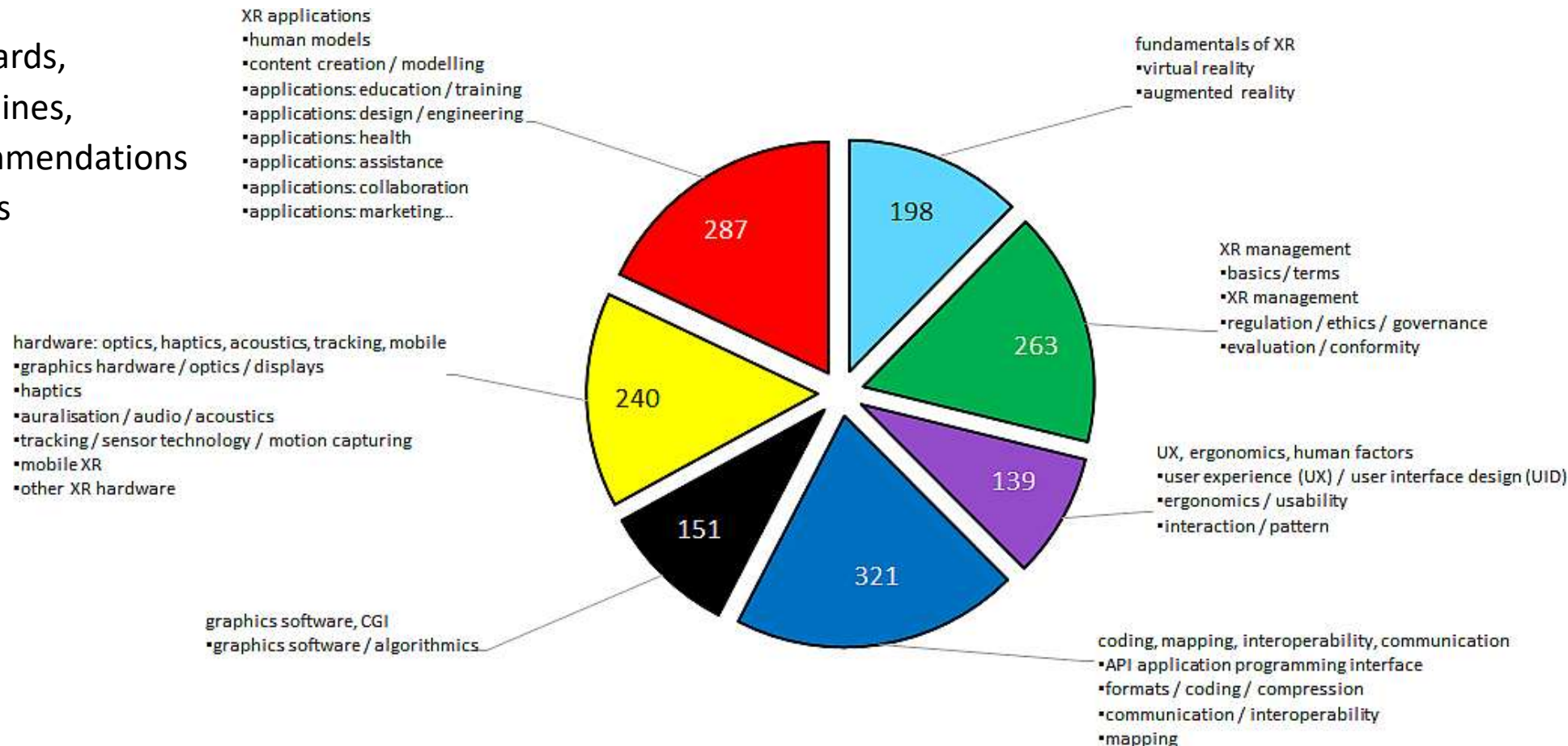


Record type	#	Notes
Standards	920+	1184 total (amendments removed)
Technical Reports, White Papers, Recommendations + Guidelines	354	415 including some other documents
Standards Development Org	130	149 includes all organizations
Standards Working Groups	378	Not all currently active
Work-in-progress		46
Total	1782	2172
+ 3 rd Party Standards Landscapes	55	

XR standards clustering: focusing on 7 topics

clustering

- XR standards,
 - XR guidelines,
 - XR recommendations
- into 7 topics



Use Cases

Operating Center - War Room



standardization requirements

- geo data and mapping
- compression and streaming
- video conferencing and collaboration
- scenario development and management

examples

- OGC “*OpenGIS City Geography Markup Language (CityGML) Encoding Standard*”
- IEEE “*P2888.3 Standard on Orchestration of Digital Synchronization between Cyber and Physical Worlds*”
- 3GPP “*Virtual Reality (VR) streaming interoperability and characterization*”
- 3GPP - TR 26.962 “*Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT) Operation and Usage Guidelines*”
- Khronos “*COLLADA 3D Asset Exchange Schema*”
- ASAM “*OpenDrive*”
- ASAM “*OpenScenario*”



Use Cases

AR assistance for MRO

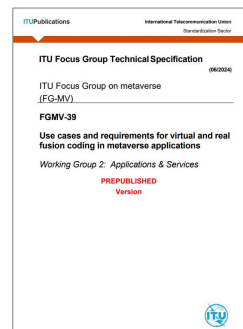


standardization requirements

- universal interaction concepts
- ergonomic design of assistive systems
- hardware-agnostic apps
- digital twinning

examples

- ISO 9241-115 “Ergonomics of human-system interaction - Part 115: Guidance on conceptual design, user-system interaction design, user interface design, and navigation design” (wip)
- ISO 9241-300 “Ergonomics of human-system interaction — Part 300: Introduction to electronic visual display requirements”
- ITU-T - FG-MV-2023-19 “Service scenarios and high-level requirements for metaverse cross-platform interoperability”
- ITU-T - FG-MV-2024-28 “Requirements for the metaverse based on digital twins enabling integration of virtual and physical worlds”
- ITU-T - FG-MV-2024-29 “Reference model for the metaverse based on a digital twin enabling integration of virtual and physical worlds”
- ITU-T - FG-MV-2024-39 “Use cases and requirements for virtual and real fusion coding in metaverse applications”



Use Cases

Training and learning



standardization requirements

- learning management
- meta data for learning resources
- human factor guidelines
- didactic concepts
- scenario development and management

examples

- IEEE 1589 ARLEM “*Standard for an Augmented Reality Learning Experience Model*”
- ISO-IEC 23127-1 “*Information Technology - Learning, education, and training - Metadata for facilitators of online learning - Part 1: Framework*”
- ISO-IEC 23842-1 “*Information technology for learning, education and training — Human factor guidelines for virtual reality content — Part 1: Considerations when using VR content*”
- ISO-IEC TR 18121 “*Information technology - Learning, education, and training - Virtual experiment framework*”
- OGC “*CDB Vol06 Rules for Encoding Data using OpenFlight 1.2*”
- SAE “*ARINC450-1 Flight Simulator Design and Performance Data*”



Use Cases

Assistance and navigation for the field

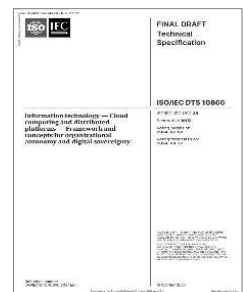
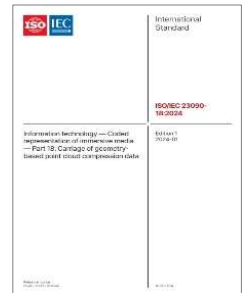


standardization requirements

- geo data and mapping
- compression and streaming
- safe and robust mobile devices
- assistance concepts
- video conferencing and collaboration

examples

- IEC 62629-1-2 “Information technology — Coded representation of immersive media. Part 18: Carriage of geometry-based point cloud compression data”
- IEEE P2048.07 “Standard for VR and AR: Map for Virtual Objects in the Real World”
- IEEE 1857.7 “Standard for Adaptive Streaming”
- UL 8400 “Standard for Safety. Virtual Reality, Augmented Reality and Mixed Reality Technology Equipment”
- ISO 92419 “Principles of the ergonomic design of assistive systems”
- ISO-IEC DTS 10866 “Information Technology - Cloud computing and distributed platforms - Framework and concepts for organizational autonomy and digital sovereignty”



Use Cases

Logistics

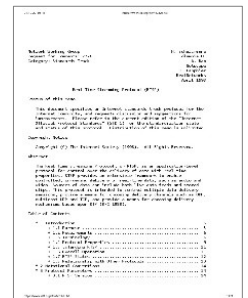
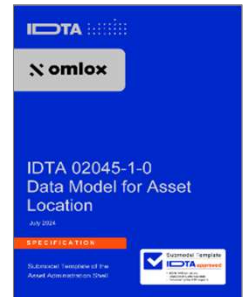


standardization requirements

- geo data and mapping
- compression and streaming
- safe and robust mobile devices
- assistance concepts
- video conferencing and collaboration

examples

- IDTA 02045-1-0 “Data Model for Asset Location”
- IEC, ANSI - 62264 - ISA-95 “Enterprise-control system integration - Part 1: Models and terminology”
- VDI 3633-01 “Simulation of systems in materials handling, logistics and production – Fundamentals”
- IETF RFC 2326 “Real Time Streaming Protocol (RTSP)”
- IEC 62629-52-1 “AR/VR safety-- guidance on safe immersion, set up and usage”
- ETSI GR ARF 002 V1.1.1 “Augmented Reality Framework (ARF). Industrial use cases for AR applications and services”
- ITU-T P.IXC “Interactive test methods for subjective assessment of extended reality communications”



Overview

Standards to be implemented for:

- 3D models
- content preparation and delivery
- compression and streaming
- distributed collaboration protocols and mechanisms
- geo referencing
- scenario definitions
- learning management
- usage and interaction

examples

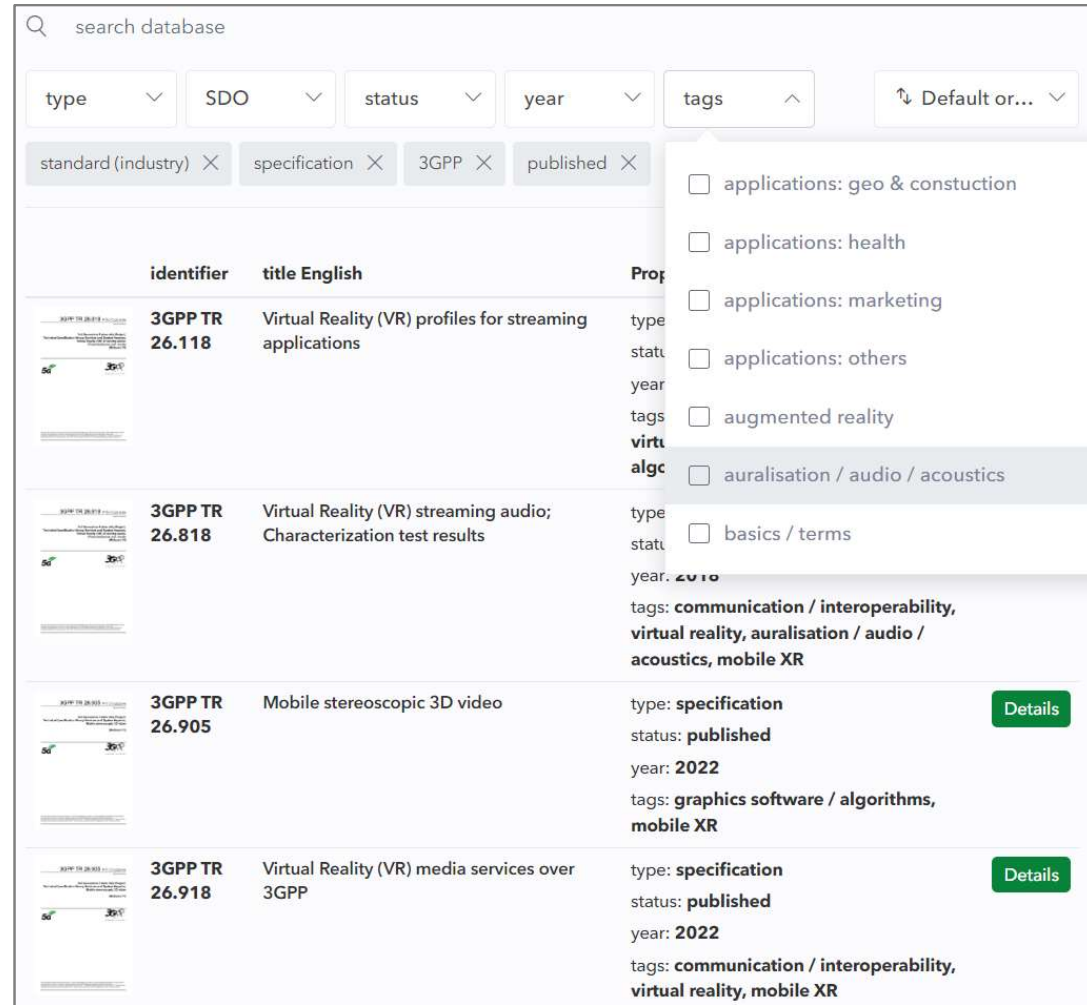
- W3C “WebXR Device API”
- Khronos “OpenXR”
- Khronos “Vulkan Safety Critical”
- ITU-T - FG-MV-2023-19 “Service scenarios and high-level requirements for metaverse cross-platform interoperability”
- ETSI GS ARF 004-4 V1.1.1 “Augmented Reality Framework (ARF); Interoperability Requirements for AR components, systems and services; Part 4: World Analysis, World Storage and Scene Management functions”
- IEC PWI 110-8 ED1 “Coded representation of immersive media - Part 28: Interchangeable scene-based media representations”



A free, online accessible database for the entire XR community with references to

They are qualified (by tags) and with a searchable description. The group's entry further comprises the organizing/leading SDO and a link to this resource in the WWW.

Please support by adding standards and SDOs.



The screenshot displays the 'search database' interface. At the top, there is a search bar and several filter dropdowns: 'type', 'SDO', 'status', 'year', and 'tags'. Below these are active filters: 'standard (industry)', 'specification', '3GPP', and 'published'. A table lists four standards, each with a thumbnail, identifier, title in English, and a 'Properties' column. The 'tags' dropdown menu is open on the right, showing a list of categories with checkboxes. The first standard is '3GPP TR 26.118' titled 'Virtual Reality (VR) profiles for streaming applications'. The second is '3GPP TR 26.818' titled 'Virtual Reality (VR) streaming audio; Characterization test results'. The third is '3GPP TR 26.905' titled 'Mobile stereoscopic 3D video'. The fourth is '3GPP TR 26.918' titled 'Virtual Reality (VR) media services over 3GPP'. The 'Properties' column for the third and fourth standards includes details like 'type: specification', 'status: published', 'year: 2022', and specific tags. Green 'Details' buttons are present next to the last two entries.

identifier	title English	Properties
3GPP TR 26.118	Virtual Reality (VR) profiles for streaming applications	type: specification status: published year: 2022 tags: communication / interoperability, virtual reality, auralisation / audio / acoustics, mobile XR
3GPP TR 26.818	Virtual Reality (VR) streaming audio; Characterization test results	type: specification status: published year: 2022 tags: communication / interoperability, virtual reality, auralisation / audio / acoustics, mobile XR
3GPP TR 26.905	Mobile stereoscopic 3D video	type: specification status: published year: 2022 tags: communication / interoperability, virtual reality, auralisation / audio / acoustics, mobile XR
3GPP TR 26.918	Virtual Reality (VR) media services over 3GPP	type: specification status: published year: 2022 tags: communication / interoperability, virtual reality, auralisation / audio / acoustics, mobile XR

search for actual standards

- example: search for published standard from ANSI and CTA

search database

type SDO status tags Default order

standard (industry) X standard (official) X technical report X ANSI X CTA X published X Reset all

identifier	title English	Properties
 ANSI/CTA 2085	Definitions and Characteristics for VR Video and VR Images	type: standard (official) status: published year: 2019 tags: basics / terms, virtual reality, graphics software / algorithms Details
 ANSI/CTA 2087	Recommendations and Best Practices for Connection and Use of Accessories for XR Technologies	type: standard (official) status: published year: 2019 tags: XR management, virtual reality, augmented reality, ergonomics / usability, other XR hardware, applications: others Details
 ANSI/HFES 100-2007	Human Factors Engineering of Computer Workstations	type: standard (official) status: published year: 2007 tags: evaluation / conformity, ergonomics / usability, graphics hardware / optics / displays Details
 CTA 2095	Best Practices for Limited Mobility in XR	type: standard (industry) status: published year: 2021 tags: XR management, regulation / ethics / governance, virtual reality, augmented reality, user experience (UX) / user interface design (UID) Details
 CTA 2103	Best Practices for Diversity in XR	type: standard (industry) status: published Details

search for recommendations

- example: search for recommendations on regulation / ethics / governance

search database

type SDO status tags Default order

recommendation / guideline X regulation / ethics / governance X Reset all

identifier	title English	Properties
 ConnectSafely MV & Parents	Metaverse and Virtual Reality Safety Tips for Parents	type: recommendation / guideline status: published tags: regulation / ethics / governance, applications: entertainment / culture Details
 Council of the European Union Metaverse	Metaverse - Virtual World, Real Challenges	type: recommendation / guideline status: published year: 2022 tags: XR management, regulation / ethics / governance, virtual reality, augmented reality Details
 Cyber-XR Coalition Cyber XR-2020-1.0	Immersive Technology Standards for accessibility, inclusion, ethics, and safety	type: recommendation / guideline status: published year: 2020 tags: regulation / ethics / governance Details
 European Parliament Metaverse	Metaverse Opportunities, risks and policy implications	type: recommendation / guideline status: published year: 2022 tags: XR management, regulation / ethics / governance, virtual reality, Details

search for upcoming standards

- example: search for standards with status “draft” or “work in progress” in the field of graphics hardware / optics / displays

search database

type: SDO status: tags: Default order

specification X standard (industry) X standard (official) X draft X work in progress X

graphics hardware / optics / displays X Reset all

identifier	title English	Properties
 IEC 62629-1-3	future IEC/TR 62629-1-3 ED1: 3D display devices - Part 1-3: Depth perception and determination of the position of 3D object on the non-physical screen	type: standard (official) status: work in progress tags: interaction / patterns, graphics hardware / optics / displays Details
 IEC 62629-1-3 ED1	3D display devices - Part 1-3: Depth perception and determination of the position of 3D object on the non-physical screen	type: standard (official) status: work in progress tags: graphics hardware / optics / displays Details
 IEC 62629-502-1	3D Display devices - Measurement method of plane-symmetrical real-image-forming optics for aerial display	type: standard (official) status: work in progress year: 2023 tags: evaluation / conformity, graphics hardware / optics / displays Details
 IEC 62629-52-1 ED1	3D Display devices - Part 52-1: Fundamental measurement methods of aerial display - Optical	type: standard (official) status: work in progress year: 2024 tags: evaluation / conformity, graphics hardware / optics / displays Details
 IEC 62629-62-12 ED1	3D display devices - Measurement methods for virtual-image type - Image Quality	type: standard (official) status: work in progress year: 2024 Details

search for SDOs and working groups

- example: search for standards development organizations (SDOs) and working groups in the field of education and engineering

search database

type: SDO status: tags: Default order

SDO X working group X applications: education / training X applications: design / engineering X Reset all

identifier	title English	Properties
 AREA	Interoperability and Standards program	type: SDO year: 2013 tags: XR management, evaluation / conformity, augmented reality, applications: education / training, applications: design / engineering, applications: assistance, applications: others Details
 ASAM	Association for Standardization of Automation and Measuring Systems	type: SDO year: 1998 tags: evaluation / conformity, communication / interoperability, applications: design / engineering Details
 BDSV	BDCG Simulation	type: working group tags: applications: education / training Details
 DIN	DIN Work Innovation	type: working group tags: applications: education / training, applications: design / engineering, applications: collaboration, applications: others Details
 DIN	DIN I4.0	type: working group tags: applications: design / engineering, applications: others Details
 DIN	DIN NIA	type: working group tags: applications: education / training, applications: design / engineering, applications: health, applications: assistance, applications: collaboration, applications: marketing, applications: entertainment / culture, applications: geo & construction, applications: others Details
ETSI ISG-ARF	Industry Specification Group (ISG)	type: working group Details



Our interest: transfer from defense to civil

156	Correlated Dynamic Synthetic Environments for Distributed Simulation	IST-173 (AI2S)	Mission-Oriented Research for AI and Big Data for Military Decision Making
ANEP-61-2001	Guidance in the use of simulation and virtual prototyping in ship design	IST-AVT-213	Implementation, Integration and Development of Augmented Reality in Land Platforms
MSG-159	Reference Architecture for Human Behaviour Modelling in Military Training Applications	IST-ET-013	Use of Intelligent Agents in Virtual Reality
MSG-ET-206	Common Framework for the assessment of XR Technologies for Use in Training and Education	MSG-127	Reference Architecture (RA) for human behaviour modelling
TR-AVT-290	Augmented Reality for Improved Situational Awareness and Survivability of Combat Vehicles	MSG-140	Urban Combat Advanced Training Technology (UCATT) Live Simulation Standards
HFM-MSG-323	Guidelines for Mitigating Cybersickness in Virtual Reality Systems	MSG-146	Simulation for Training and Operation Group-Land (STOG-L)
AVT-256	Augmented Reality for Improved Situational Awareness and Survivability of Combat Vehicles	MSG-162	Guideline for Scenario Development
AVT-290	Standardization of Augmented Reality for Land Platforms in Combat Environments	MSG-173	Simulation for Training and Operation Group – Next Generation (STOG-NG)
AVT-334	CDT on Augmented Reality (AR) to Enhance Situational Awareness for Armoured Fighting Vehicle Crew	MSG-174	Urban Combat Advanced Training Technology - Live Simulation Standards (UCATT-LSS)
AVT-ET-169	Standardization of Augmented Reality for Improved Situational Awareness in Combat Vehicles	MSG-181	Physics-Based Electro-Optic/Infrared Simulations – Best Practice Recommendations for Decision Support
AVT-HFM-ET-216	Human Systems Integration of Augmented Reality for Land Platforms in combat environments	MSG-189	AI augmented immersive simulation in Training and Decision Making Course of Actions Analysis
AVT-IST-398	Development of a STANREC for Augmented Reality in Land Platforms	MSG-203	The Role of Modelling and Simulation to Support Current and Future NATO Operations
HFM-021	Human Factors In Virtual Reality Applications	MSG-206	Common Framework for the assessment of XR technologies for use in Training and Education
HFM-058	What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?	MSG-ET-049	High-Fidelity Electro-Optic/Infrared Scene Simulation for Decision Support
HFM-121	Virtual Environments For Intuitive Human-System Interaction	MSG-ET-050	Standards for xR (Virtual, Augmented and Mixed Reality)
HFM-136	Virtual Media for Military Applications	MSG-ET-052	Common Framework for the assessment of XR Technologies for Use in Training and Education
HFM-165	Improving Human Effectiveness Through Embedded Virtual Simulation	MSG-ET-30	Immersive Environments Interoperability Requirements
HFM-169	Human Dimensions in Embedded Virtual Simulation	MSG-HFM-220	Effectiveness of Medical Training based on eXtended Reality
HFM-182	Use of Advanced Technologies and new Procedures in Medical Field Operations	MSG-TR-ET-050	Standards for xR (virtual, augmented and mixed reality), Final Report, 2020
HFM-231	Beyond Time and Space	MSG-TW-010	Immersive simulation devices for improving dismantled soldier preparation with augmented and mixed reality devices
HFM-249	Emerging Technological Advances in Tactical Casualty Care	SCI-342	Explosive Ordnance Disposal (EOD) Tele-manipulation Robot Technology Roadmap Development
HFM-297	Assessment of Augmentation Technologies for Improving Human Performance	SCI-349	Heterogeneous Data-Driven Space Domain Decision Intelligence
HFM-297 RTG	Assessment of augmentation technologies for improving human performance, TAP, 6 Apr 2017	SCI-ET-052	EOD Tele-manipulation Robot Technology Roadmap Development; Operators Remotely Handling Objects with Dexterity, 3D Perception and Haptic Feedback
HFM-AVT-ET	Human Systems Integration of Augmented Reality for Land Platforms in combat environments	SET-248	Panoramic optical systems for military application
HFM-ET-077	Improving Human Effectiveness through Embedded Training	SET-305	Improved Field of View for Night Vision Goggles – Technical Challenges, Concepts, Performance Assessment
HFM-ET-137	Leveraging Technology in Psychiatry	SET-306	Improved Panoramic Situational Awareness for Vehicle Platforms – Technical Challenges, Concepts, Performance Assessment
HFM-ET-153	Assessment of Augmentation Technologies & Opportunities for Training	SET-323	Advanced Methods for Laser Dazzle Evaluation
HFM-ET-154	Assessment of Human-System Interaction (HSI) Technologies & Opportunities for Training	SET-ET-117	Panoramic Vision Systems For Military Applications
HFM-IST-ET-200	Extended Reality (XR) technology for mediated communication		
HFM-MSG-323	Guidelines for Mitigating Cybersickness in Virtual Reality Systems		
HFM-MSG-346	Assessment of Factors Impacting Cybersickness		
HFM-MSG-354	Study, Design, Building and Deployment of a CBRN XR Training Platform		
IST-013	Visualisation Of Massive Military Data-Sets: Human Factors, Applications, And Technologies		
IST-029	Use of Intelligent Agents in Virtual Reality		

Thank you for your attention.



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