Rapid Military Medical Experimentation Using a Configurable Mixed Reality Scenario Platform

Build–Train–Track as experimentation infrastructure for medical readiness

Oanh Tran, MBA, PMP • Presenter

Disclosure - and the question for today

A transparent boundary, then a direct path to the experimentation method.

DISCLOSURE

Conflict of interest

Presenter is an employee of Exonicus, Inc. Exonicus performs work under U.S. Government contracts.

Funding

Portions of this work were supported by U.S. Army SBIR Contract W51701-24-C-0044.

Official disclaimer

The views are those of the authors and do not necessarily reflect the official policy or position of the Department of Defense or the U.S. Government.

THE QUESTION

Can a training system also become a credible research instrument?

HERE TO DO

- Share a repeatable experimentation framework.
- Show what can be configured, controlled, and measured.
- Invite research collaboration around your questions.

NOT HERE TO DO

- Make a procurement or vendor-comparison claim.
- Claim XR replaces hands-on simulation.
- Overstate clinical effectiveness or assessment validity.

SCIENTIFIC EXCHANGE • ADDITIONAL TOOL IN THE TOOLKIT • CLAIMS ANCHORED TO THE EVIDENCE SHOWN

BACKGROUND

The innovation gap is not invention. It is evidence.

A promising product becomes a capability only after repeatable experimentation informs decisions.

FROM PROMISE TO CAPABILITY

Prototype	Experiment	Evidence	Decide	Capability
Plausible use case	Vary • repeat • measure	Compare behavior + results	Adapt • field • stop	Doctrine • training • workflow

The experimental requirement

Ask the same operational question repeatedly - under controlled variation - and preserve a comparable evidence record.

FOUR BOTTLENECKS

Scarce lanes

High-fidelity events are valuable, but hard to repeat often.

Instructor bandwidth

Facilitators can become the rate-limiting resource.

Scenario drift

Sites and instructors change cases in different ways.

Data disappears

Learning often ends at the debrief rather than a persistent record.

BACKGROUND

From a training system to a configurable research instrument

A decade of publications, demonstrations, user touchpoints, and operational learning changed the design question.

2017–19

Foundation

Madigan / AMTI / TATRC prototypes and autonomous virtual trauma work.

2019–23

Field + feasibility

Baghdad, Europe, Ready Medic One, and multi-site end-user feedback.

2024–25

Configurability

Army SBIR: Scenario Builder, versioned content, instrumented AAR, repeated 68W evaluation.

2025–26

Operational learning

Ukraine, NATO exercises, MSTC evaluation, offline and distributed requirements.


frontiers in Virtual Reality

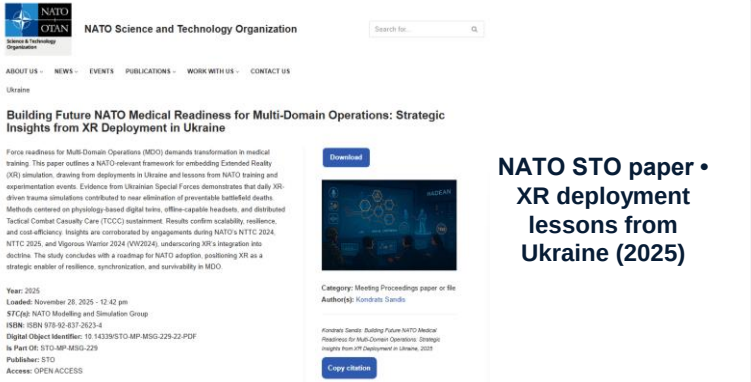
ORIGINAL RESEARCH
published: 18 January 2022
doi: 10.3389/frvir.2021.719656

Ready Medic One: A Feasibility Study of a Semi-Autonomous Virtual Reality Trauma Simulator

Robyn Lombardo[1], Nicholas Walther[1], Scott Young[1], Chad Gorbatkin[1], Zachary Sletten[2], Christopher Kang[1], Oanh Tran[1]* and Kyle Couperus[1]

[1]Department of Emergency Medicine, Madigan Army Medical Center, Tacoma, WA, United States, [2]Department of Emergency Medicine, San Antonio Military Medical Center, San Antonio, TX, United States

Peer-reviewed feasibility study
Frontiers in Virtual Reality (2022)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Ukraine

Building Future NATO Medical Readiness for Multi-Domain Operations: Strategic Insights from XR Deployment in Ukraine

Force readiness for Multi-Domain Operations (MDO) demands transformation in medical training. This paper outlines a NATO-relevant framework for embedding Extended Reality (XR) simulation, drawing from deployments in Ukraine and lessons from NATO training and experimentation events. Evidence from Ukrainian Special Forces demonstrates that daily XR-driven trauma simulations contributed to near elimination of preventable battlefield deaths. Methods centered on physiology-based digital twins, offline-capable headsets, and distributed Tactical Combat Casualty Care (TCCC) sustainment. Results confirm scalability, resilience, and cost-efficiency. Insights are corroborated by engagements during NATO's NTTC 2024, NTTC 2025, and Vigorous Warrior 2024 (VW2024), underscoring XR's integration into doctrine. The study concludes with a roadmap for NATO adoption, positioning XR as a strategic enabler of resilience, synchronization, and survivability in MDO.

Download

Year: 2025
Loaded: November 26, 2025 - 12:42 pm
STC(s): NATO Modelling and Simulation Group
ISBN: ISBN 978-92-837-2623-4
Digital Object Identifier: 10.14339/STO-MP-MSG-229-22-PDF
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Publisher: STO
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Category: Meeting Proceedings paper or file
Author(s): Kondrats Sandis

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NATO STO paper • XR deployment lessons from Ukraine (2025)

29 Military Medics (4 NATO Allied and Partner nations) from Vigorous Warrior 2026

EXPERIMENTATION

The experimentation “box”

Hold the interior stable. Change one condition deliberately. Observe what changes.

HELD CONSTANT

- Injury + patient state
- Equipment + resources
- Environment + time pressure
- Team roles
- Instructor / prompt model
- Scenario version
- Scoring / observation plan

VARIED ON PURPOSE

Example: treatment or communication sequence

OBSERVE • TIME • ORDER • COMMUNICATION • OMISSIONS • PATIENT-STATE CHANGES

Have you used simulation as part of a study?

Did scenario drift, facilitator variation, or incomparable data make the study harder?

RULE OF THUMB

Different boxes suit different questions.

If the interior cannot be held stable enough for the question, the box is decorative—not experimental.

RESEARCH QUESTIONS

What can this box study well?

Questions about care delivery, coordination, training, and measurement not a substitute for biological efficacy research.

Workflow + protocol

VARY Sequence, timing, decision rule

OBSERVE Time to action • omissions • downstream flow

Team coordination

VARY Roles, communication model, team structure

OBSERVE Handoffs • workload • decision latency

Equipment + kit set

VARY Availability, layout, substitutes, scarcity

OBSERVE Selection • delays • task completion

Training design

VARY Dose, spacing, guidance, feedback

OBSERVE Learning curve • retention • error patterns

Distributed care + handoffs

VARY Location, delay, interface, handoff format

OBSERVE Information loss • coordination • reassessment

Performance measurement

VARY Scenario, cohort, rubric, stressor

OBSERVE Actions • timing • sequence • outcome state

BEST POSITIONED TO STUDY how care is delivered

NOT DESIGNED TO PROVE the biological efficacy of an intervention

Configurable Mixed Reality Scenario Platform

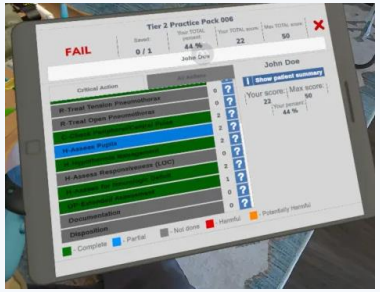
01
BUILD
governed scenarios

Fixed roles, SOPs, environment, presentation. The scenario is a cartridge: authored once, versioned, and reused across sites so the interior of the box stays constant.

02
TRAIN
execution

Modality (in-headset / hybrid / tablet), repetition, instruction model. This is where the isolated variable is applied, dose, kit, protocol, cohort.

03
TRACK
time-stamped evidence



Behavior, performance, variation, variation, captured at millisecond millisecond resolution. What was was done, when, and by whom. whom. The evidence record is what makes the box a testbed rather than a demo.

GOVERNED SCENARIOS · REPEATABLE EXECUTION · STRUCTURED EVIDENCE

MODALITIES

Choose the modality after the research question

Three experimentation boxes with different strengths, limits, and resource requirements.

IN-HEADSET MR

Highly standardized

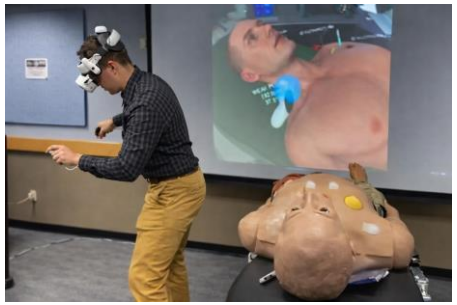
BEST FOR Decision-making, repeated reps, distributed participants

STRENGTH Identical presentation + dense native data

TRADEOFF Limited haptics, weight, and concurrent multi-patient work

HYBRID INTEROPERABLE

Physical + digital



BEST FOR Physical intervention, team workflow, sensorized tasks

STRENGTH Real equipment + shared modeled patient state

TRADEOFF More setup; sensor and interface maturity vary

TABLET + MANIKIN

Lane-style realism

BEST FOR Multiple providers/patients, movement, logistics

STRENGTH Physical context + standardized event capture

TRADEOFF More facilitator and real-world variability

ADD TO THE TOOLKIT • STANDARDIZED PATIENTS • MANIKINS • PART-TASK TRAINERS • LVC / MEDICAL M&S • DISTRIBUTED SIMULATION

What the evidence supports today

FORT CAVAZOS • JAN 2025

23 military medics (68W)

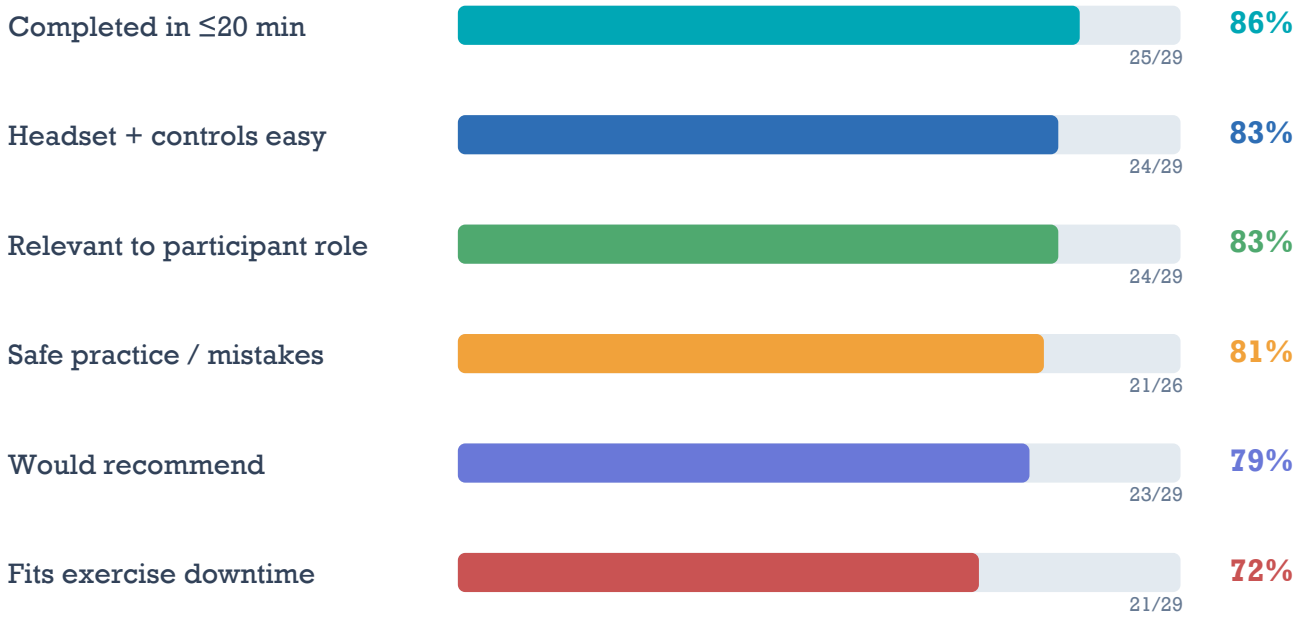
95.8% support continued use

95.6% useful for TCCC sustainment

91.3% resembled real-life factors

VW2026 MATCHED END-USER MicroDrill Exercise • n = 29 VALID RESPONSES

Self-reported operational fit



THE TAKEAWAY

Pilot-to-Scale playbook · Hub-and-Spoke

Configure the question. Standardize the repetition. Track what changes.

PILOT-TO-SCALE PLAYBOOK

1. **PILOT** — One question • one cohort • one baseline
2. **COMPARE** — Sites • modalities • conditions • versions
3. **ADAPT** — Scenario • workflow • instructor model
4. **SCALE** — Only what produces repeatable evidence

Configure the question • Standardize the repetition • Track what changes

Military experimentation should produce decisions, not demonstrations.

Acknowledgements

Contributors and collaborators supporting the work described in this presentation

Co-Authors

- Kyle Couperus, MD, MBA, BSN[1]; Azhar Kimanje[1]; Emily Walters[1]; Chad Josewski, MS[1]; Sandis Kondrats, MA[1]
- Erin Honold, MS[2]; Catherine Strayhorn[2]
- Rachel Clipp, PhD[3]; Aaron Bray, PhD[3]
- William “Bill” Pike, PhD[4]; Sophia Caffery[4]

Affiliations

- [1] Exonicus, Inc.
- [2] IVIR, Inc.
- [3] Kitware, Inc.
- [4] U.S. Army DEVCOM Soldier Center, Simulation and Training Technology Center (STTC)

Additional support

The presenter also acknowledges support and feedback from Army Applications Laboratory, MEDCoE/CPE ST3 stakeholders, Exonicus research and development staff, advisors, collaborators, and military end users who contributed operational feedback.

Acknowledgement does not imply endorsement by the U.S. Government, Department of Defense, or any collaborating organization.

“It takes a village to build meaningful capability- and apparently, quite a few acronyms too.”

What are you already developing or evaluating that would benefit from a repeatable simulation box?

Q&A

SCAN ME

Thank you

Oanh Tran • oanh.tran@exonicus.com