

Development of *Hybrid & In Silico* Models & Experimental Simulators: Moving Concepts to Action

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A thought...

Data is the *currency* of future science and discovery... the accuracy and integrity of these data will define the potential for reliable and successful solutions... many of these solutions will be realized through modeling and simulation before they are experienced and appreciated in the real-world

Military Problems

Future Warfare

Similar to Moore's Law, current projections and trends indicate a continued evolution of unmanned systems operated by remotely located humans into semi-autonomous then autonomous actors on the military stage. In the future environment, autonomous systems and machines rather than man, will likely be the more significant arbiters of battlefield outcome.



Conventional/Kinetic



Chem/Bio



Nuclear



Pure Cyber



Nanotech



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Robotic



Space-Based



New and Unknown

Future Possible

You can never properly predict the future as it really turns out... However, the future of medicine is already well underway and will continue to evolve and change at ever increasing rates. Advanced medical technologies and processes are not just concepts, they are as inevitable as the car, computer and mobile phone.



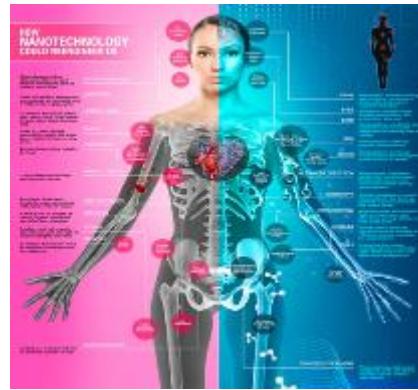
Clinical Decision Support



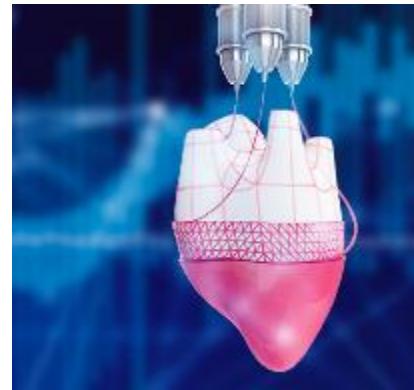
AI-Based Monitoring



Surgical Robotics & Autonomous Medical Devices and Systems



Nanotech



On-Demand Bioprinting

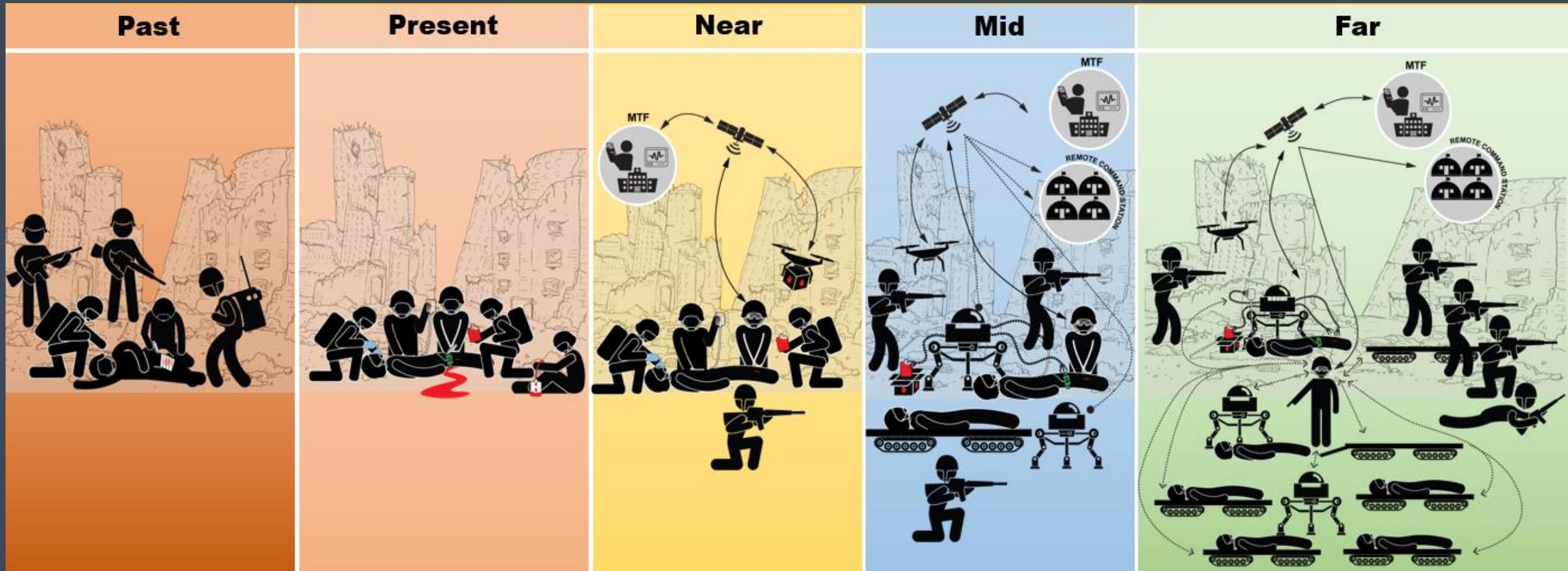


Human Augmentation



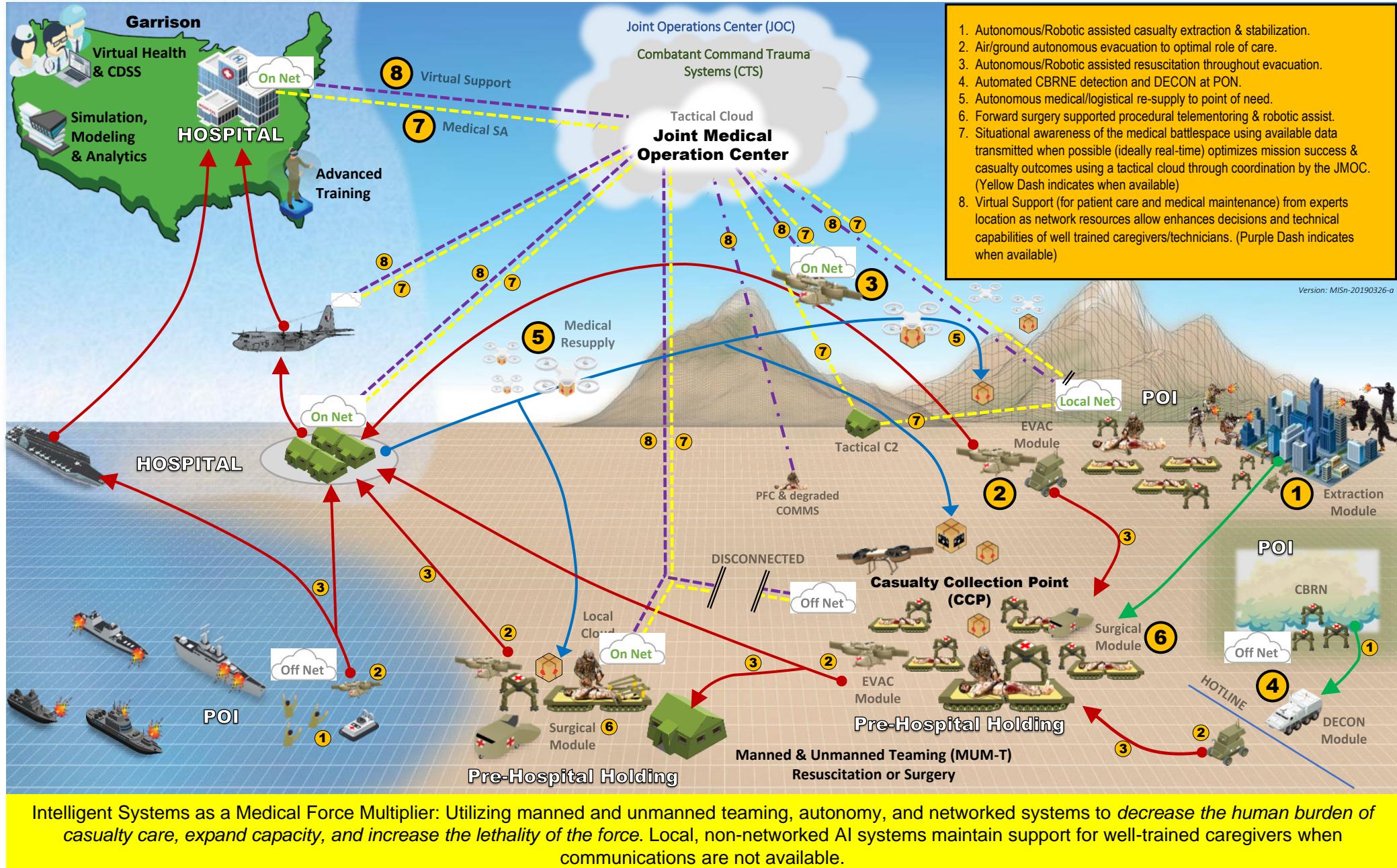
New and Unknown

Military medical support over time



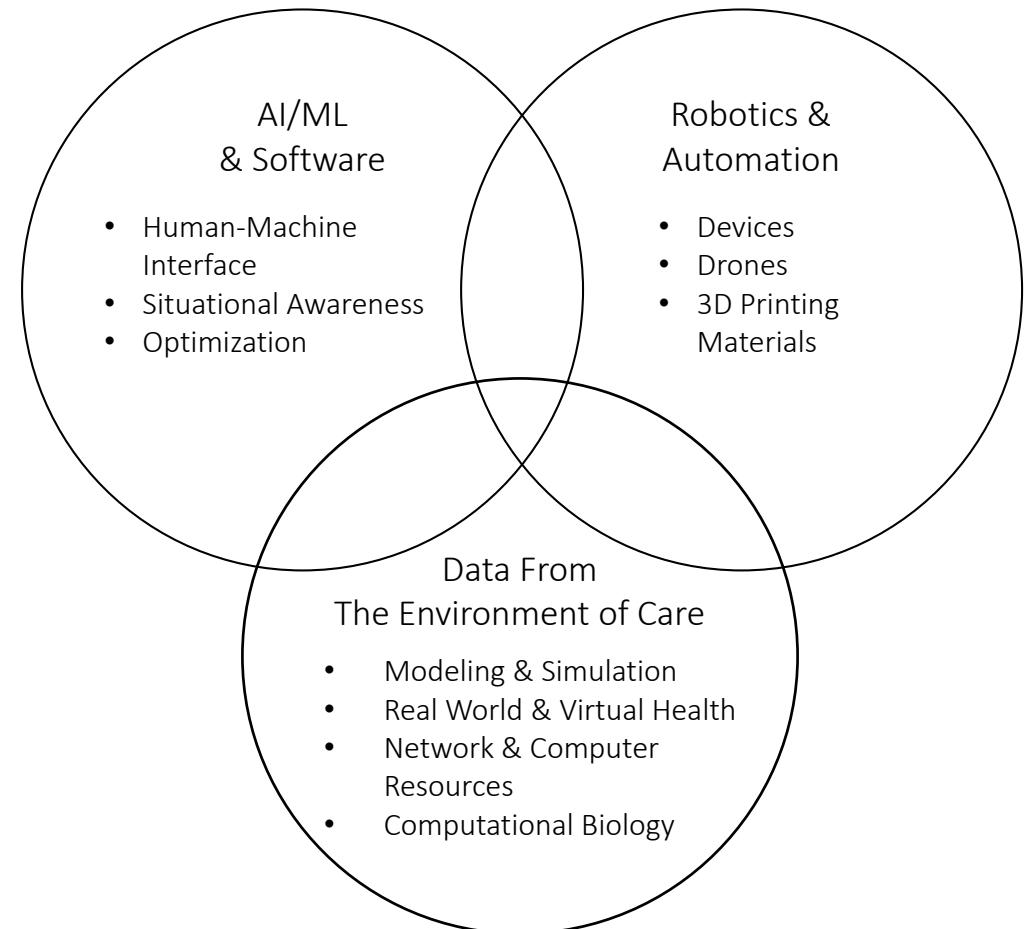
In the future, man-unmanned teams will increase caregiver capability and capacity through decision support, autonomous/semi-autonomous, and robotic systems that work together to optimize health and achieve best outcomes.

Medical Intelligent Systems: Virtual support, robotics & autonomy (notional)



Telemedicine & Advanced Technology Research Center (TATRC)

- Forging the future by fusing data humans and machines into solutions that optimize warfighter performance and casualty care
- A history of subject matter expertise in the technology, medical, and operational domains that guide research and development priorities without wasting resources



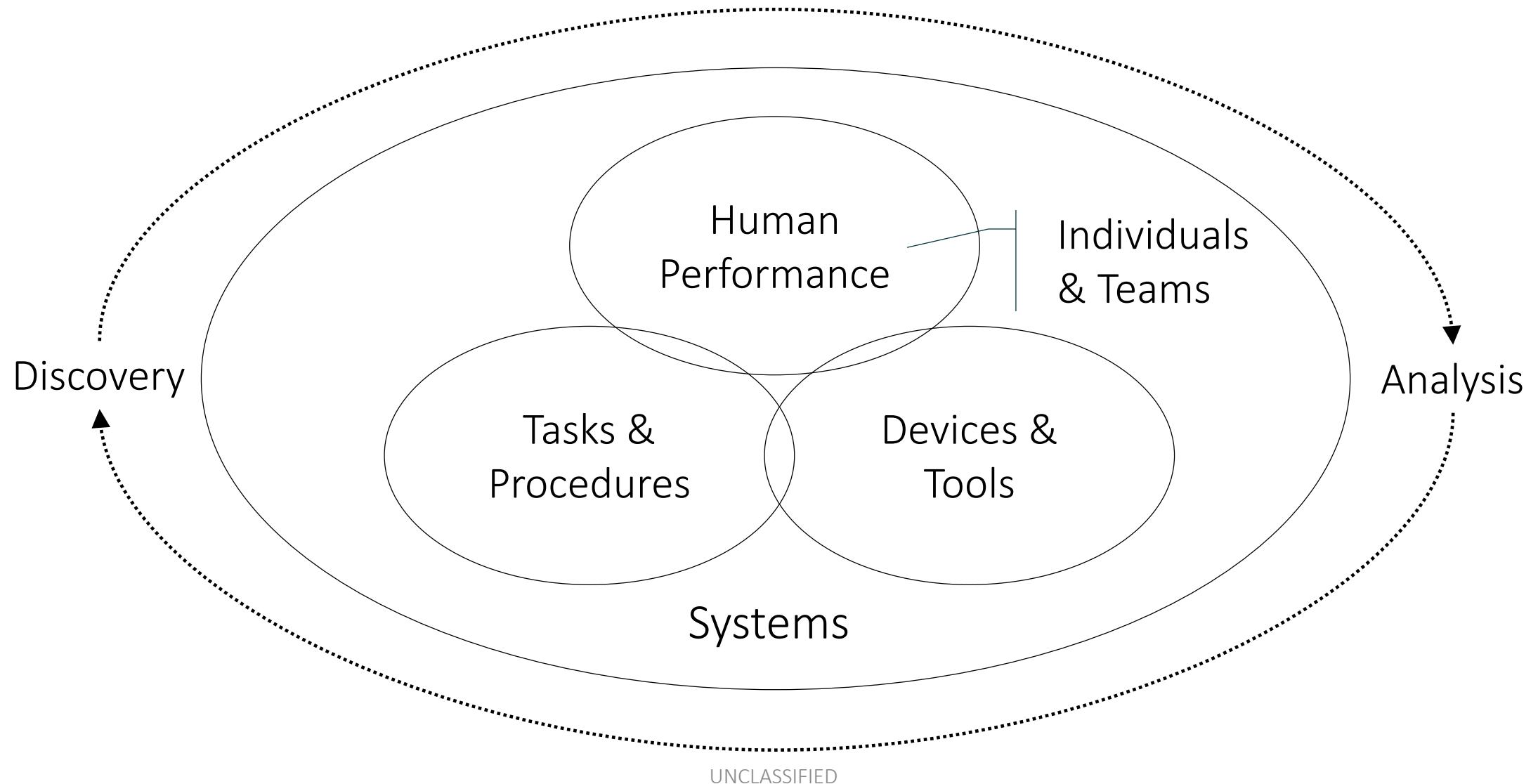
TATRC MMSIV – Applications in research

Advancing military medical excellence through innovative research and development using medical modeling, simulation, informatics, and visualization technologies to ensure military personnel are prepared for optimal mission performance across the entire range of military activities and operations.

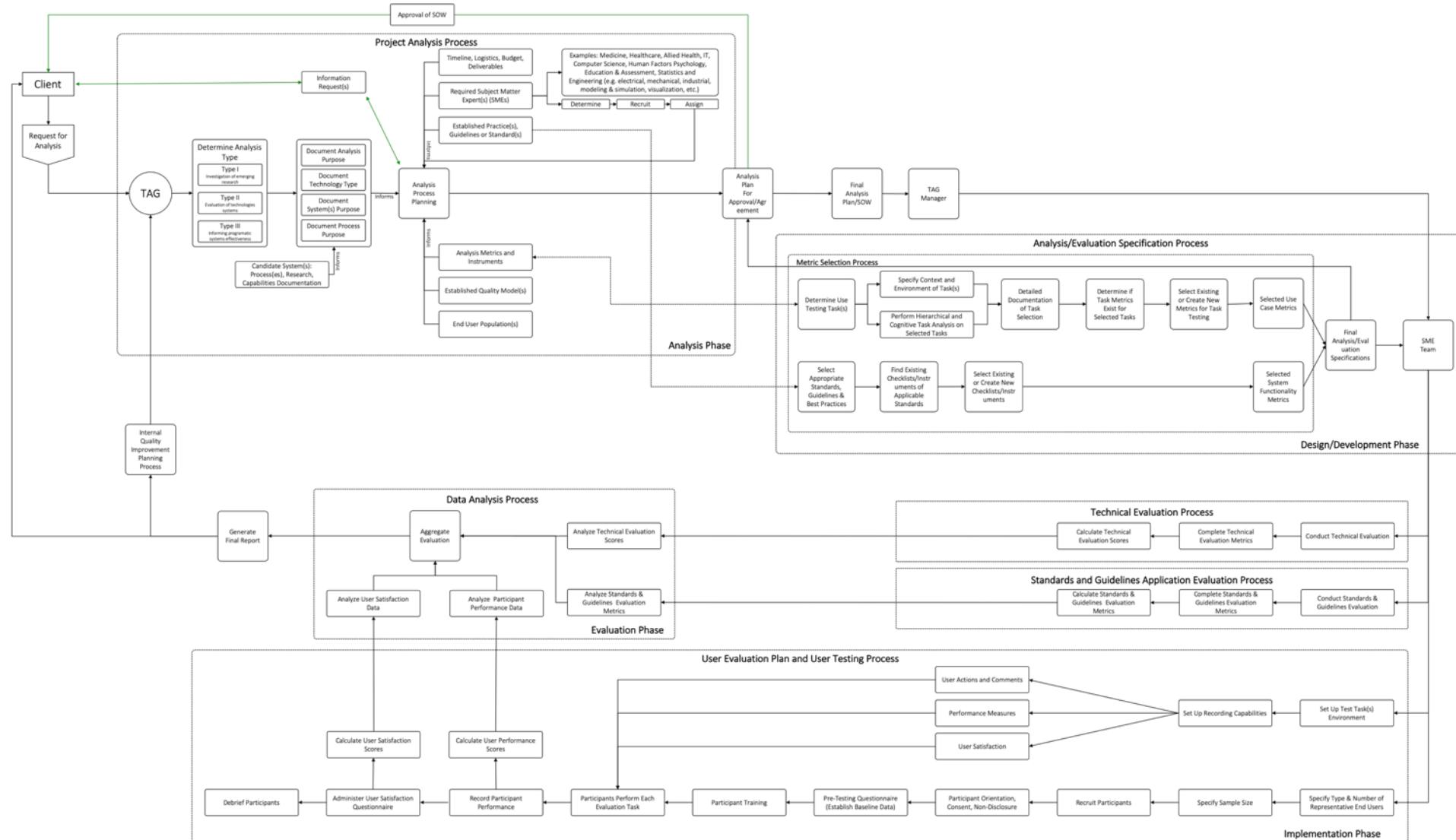
Modeling, Simulation and Visualization for:

- » Human Performance
- » Tools and Technologies
- » Medical Care
- » Operational Medical Systems
- » Virtual/Digital Health
- » Operational Medicine
- » Medical Robotics
- » Medical Autonomous Systems
- » Data Analytics

A human factors approach

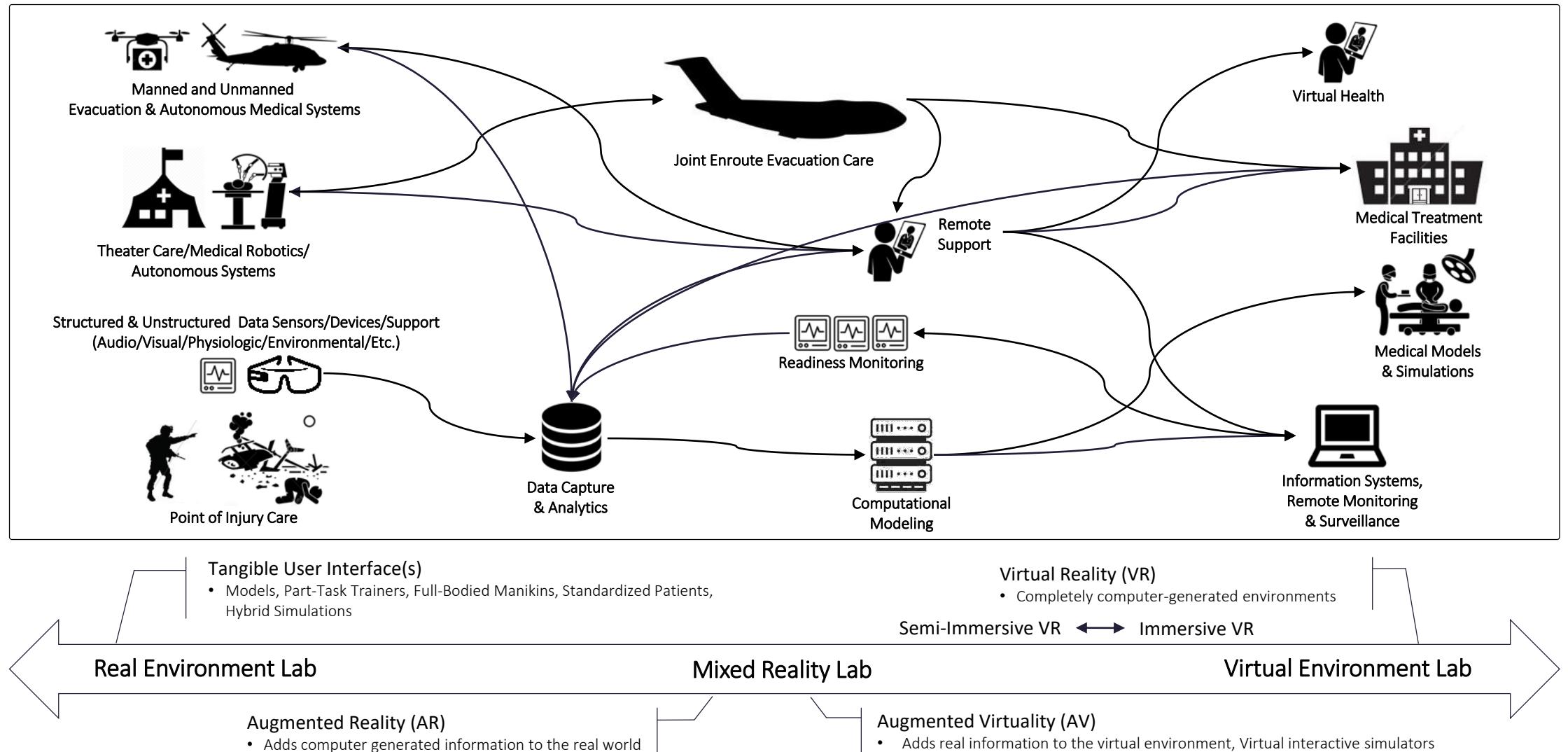


Systematic analysis processes



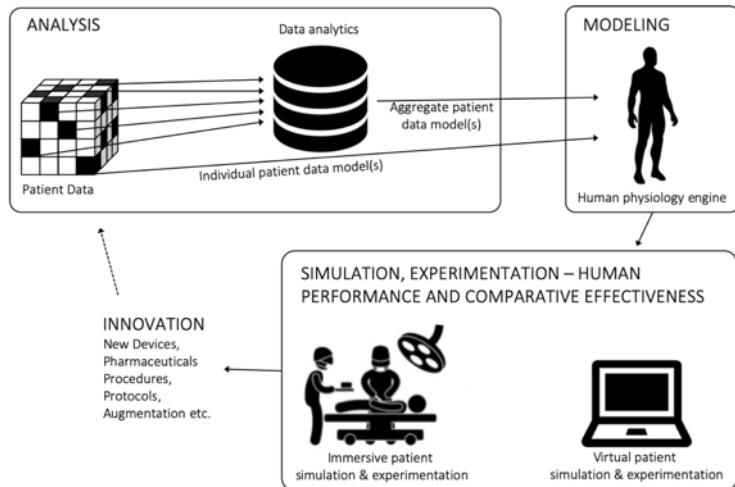
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Research environment

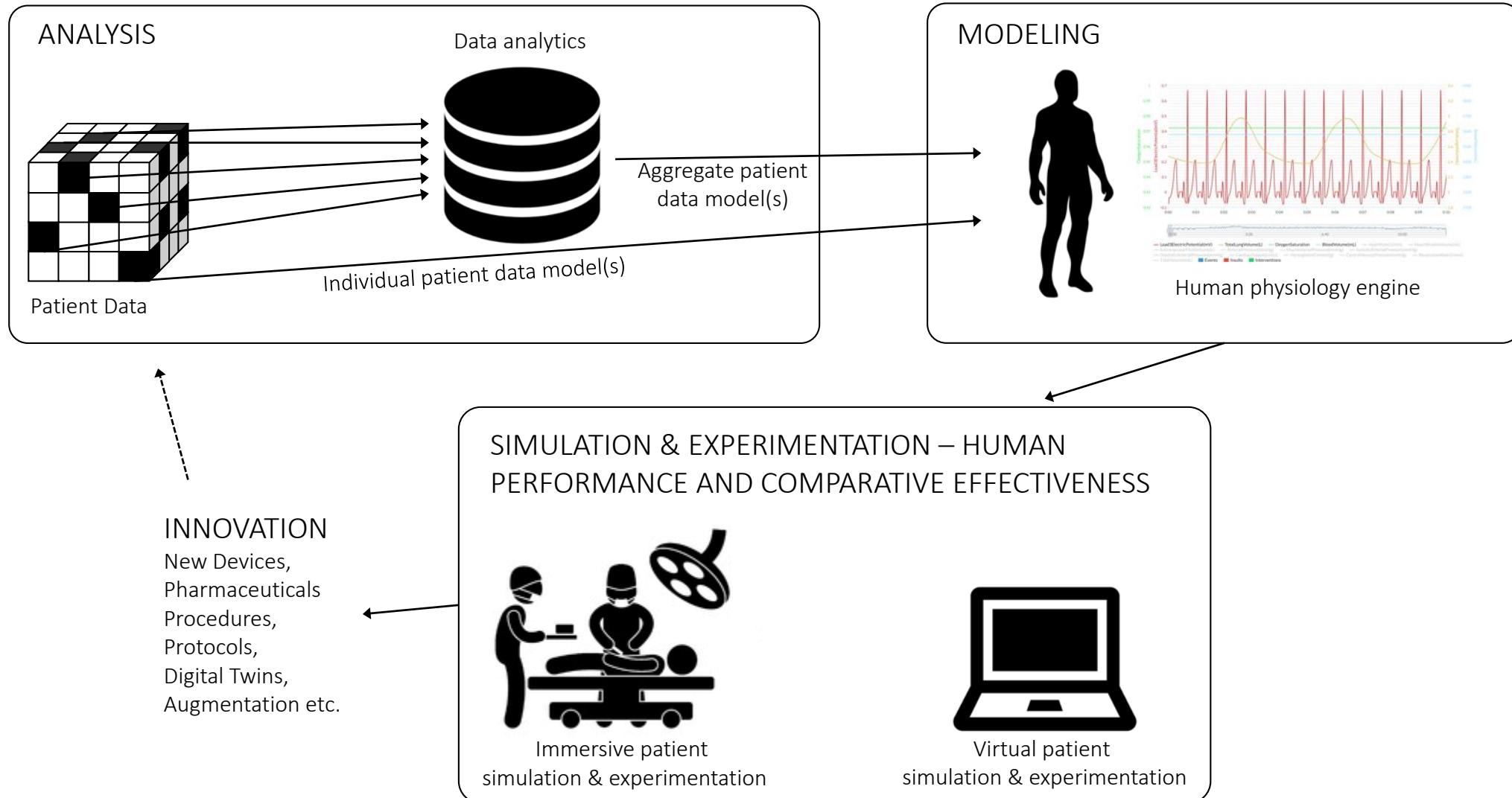


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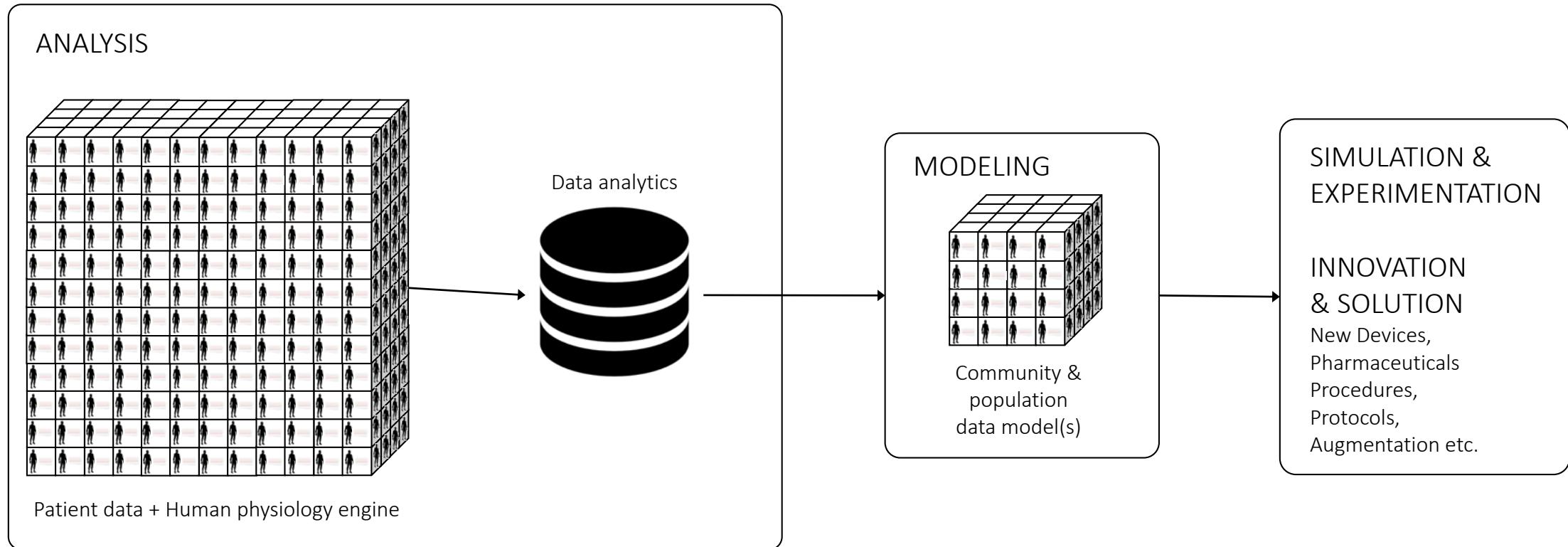
Current efforts & applications



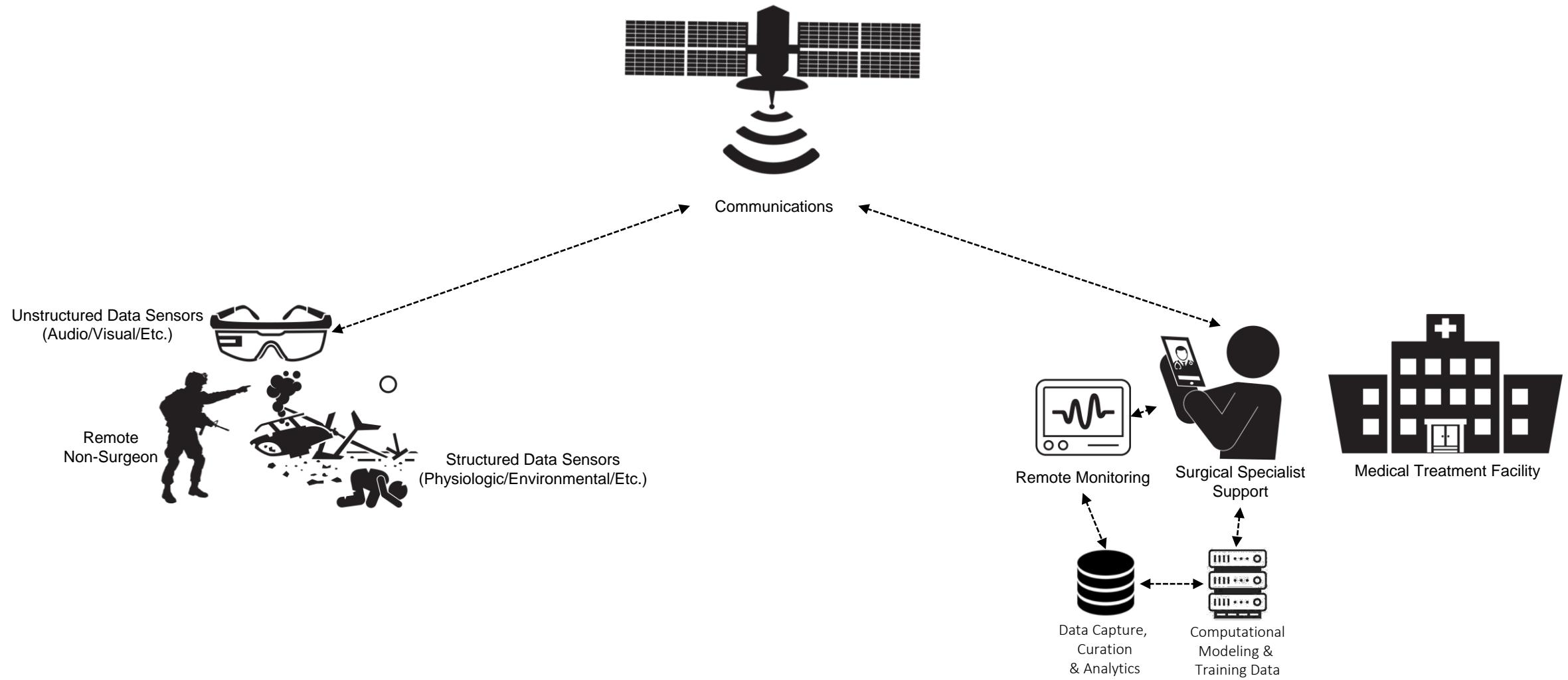
Patient-level modeling & experimental simulation



Community & population-level modeling & experimental simulation



Forward surgical support concept



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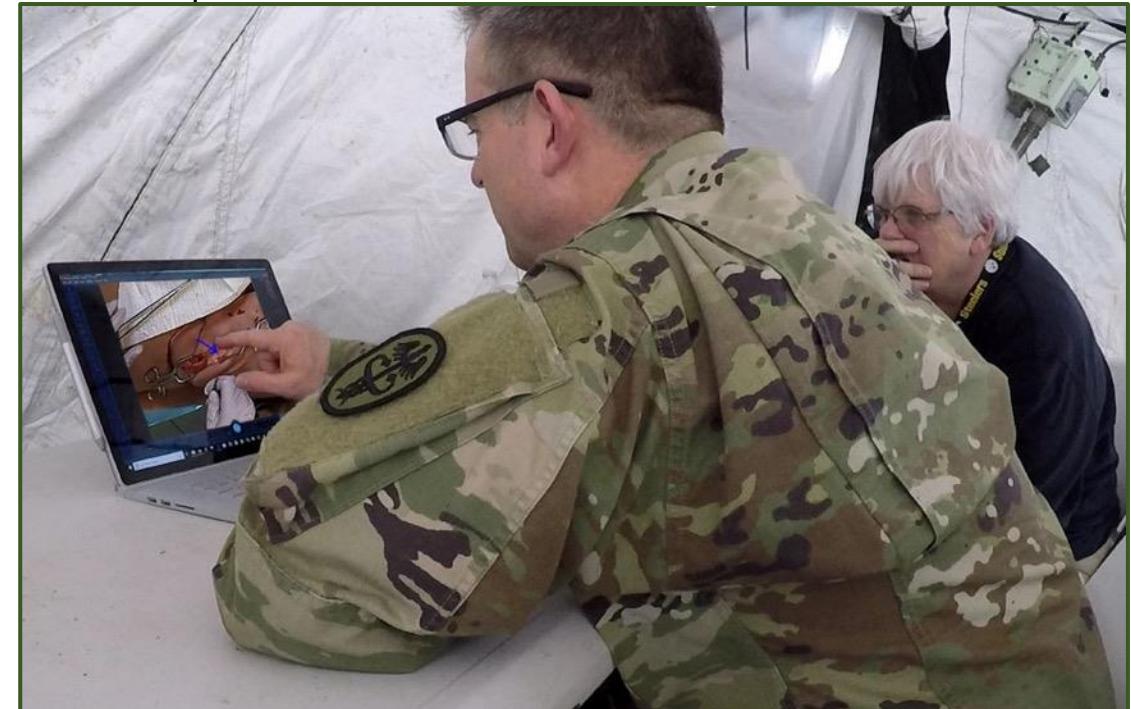
Forward surgical support concept

Problem: “Medic PFC” lacks knowledge, skill, ability, and/or experience with life-saving procedures



LOCAL SIDE

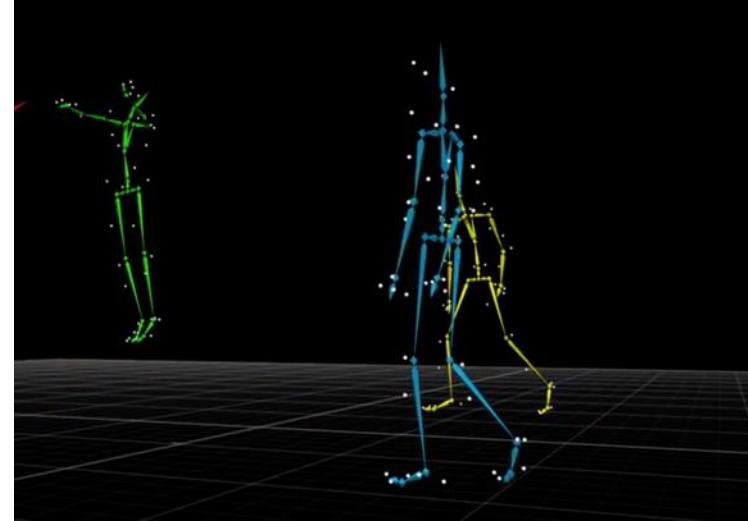
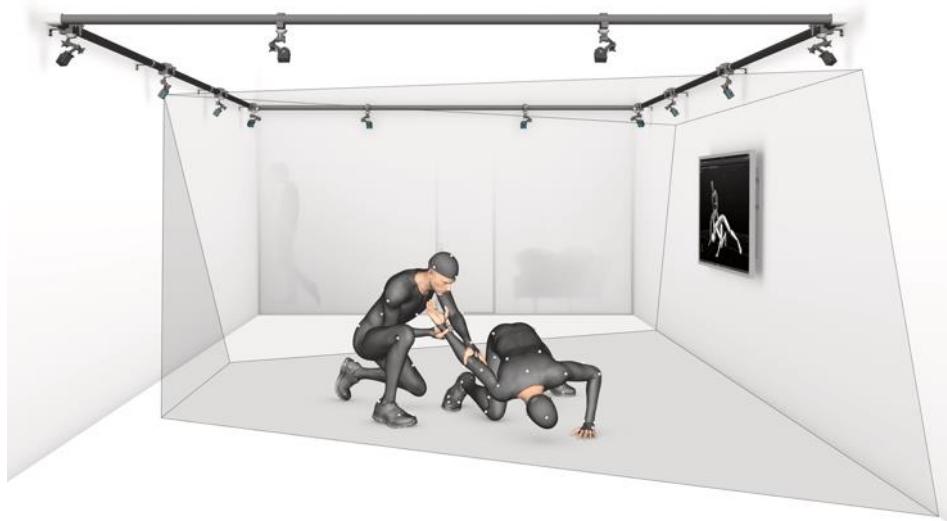
Solution: telemedicine using first-person point-of-view augmented reality procedural telementoring with backup SOP/procedure



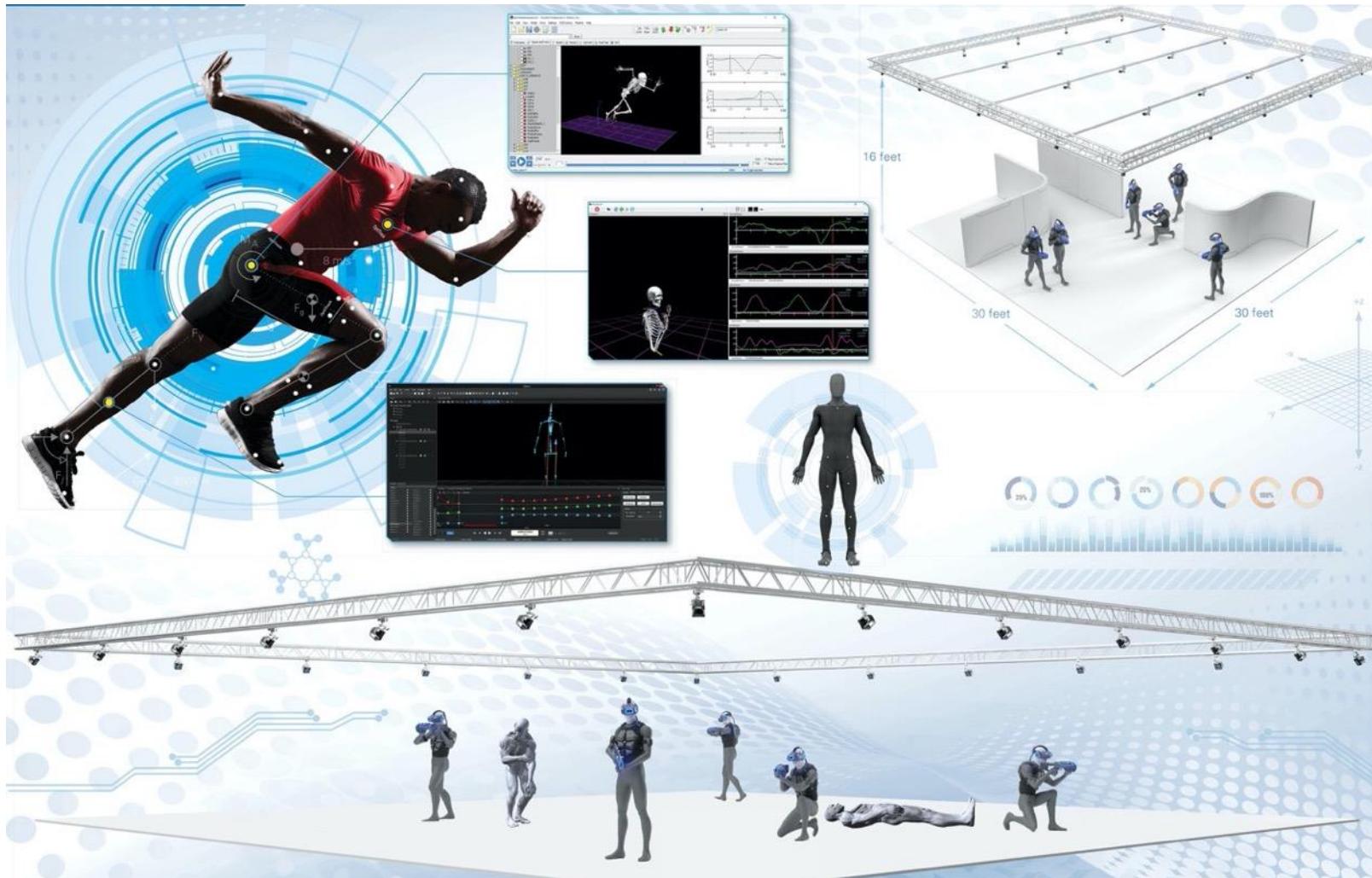
REMOTE SIDE

Human performance in healthcare modeling

- Focused on the measurement of human performance in healthcare related to specific real-time, 3D psychophysiologic measurements of clinical procedural skills performed by individuals and teams.

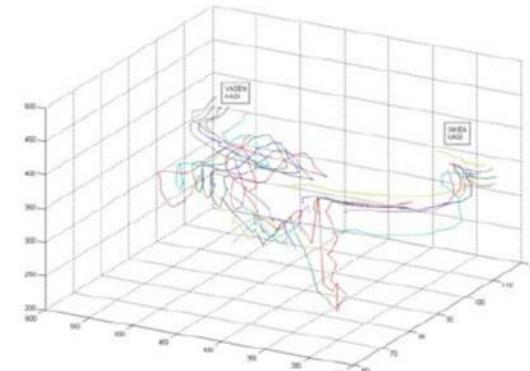
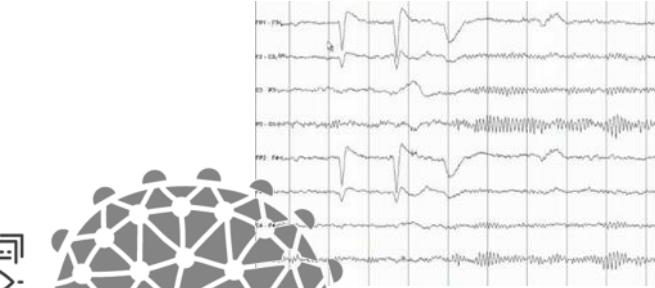
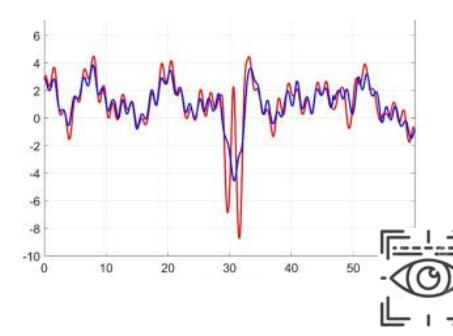
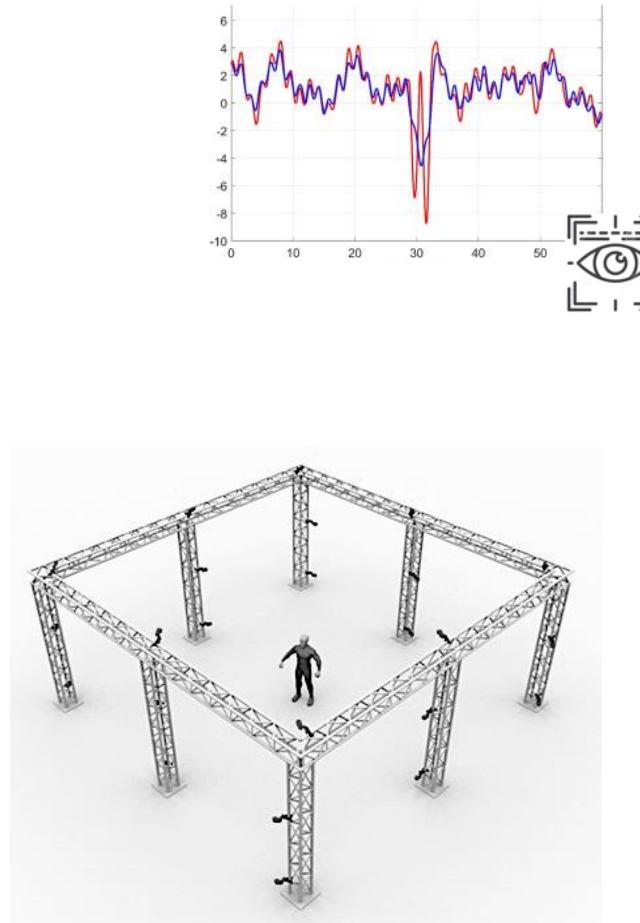
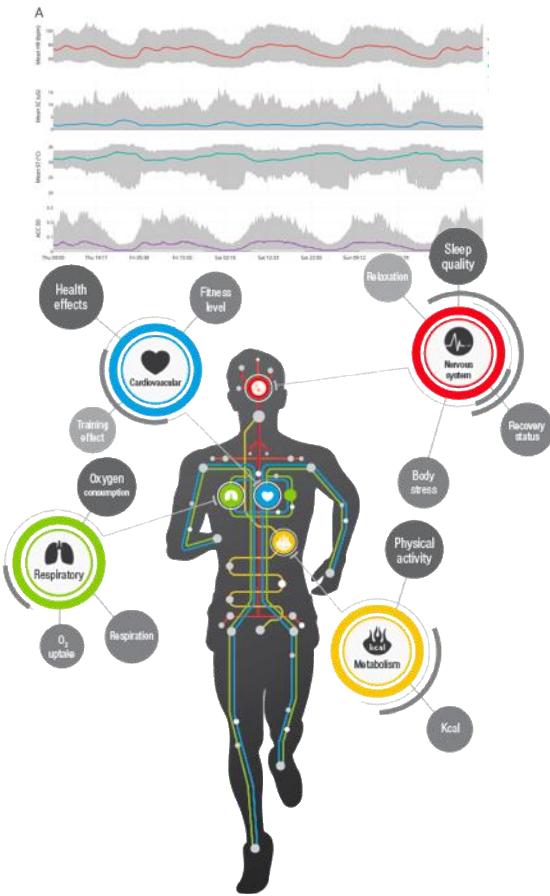


Human performance in healthcare laboratory



- » Motion analysis:
 - » Individuals
 - » Isolated Procedures
 - » Teams
- » Object recognition & event tracking analysis
- » Psychophysiological monitoring & analysis
 - » Physical stress
 - » Cognitive load/saturation
- » Laboratory & situated operational environments

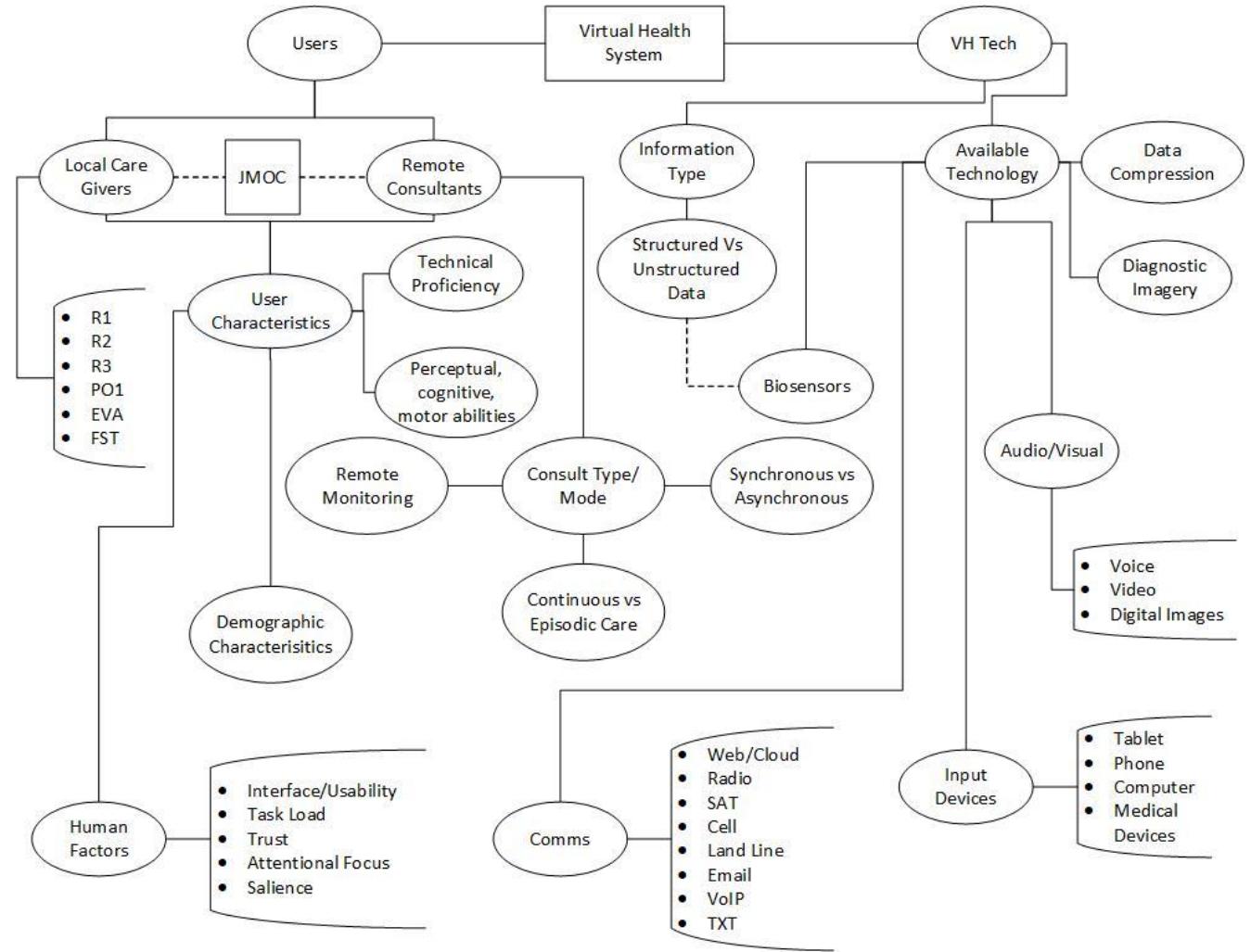
Human performance in healthcare laboratory



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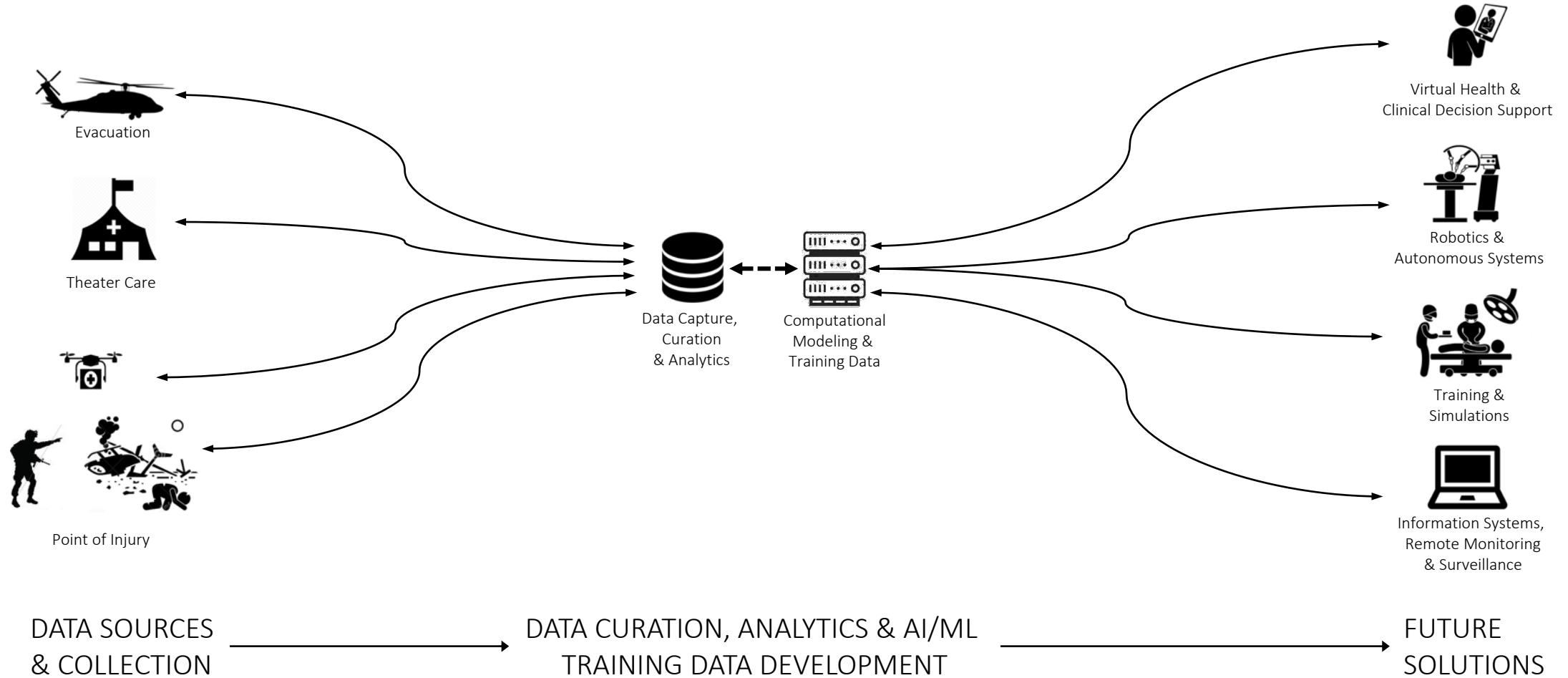
Optimization & automation of virtual health data capture, prioritization & communication to improve combat casualty care

- Describe minimum data requirements, clinical prioritization, and communication modalities by systematically quantifying and categorizing information and approaches required to augment care, tools, techniques and methods for the pre-hospital environment.
- Leverage minimum data requirements, clinical priorities and communication modalities to develop an enhanced model for the future medical battlespace ecosystem. (including methodologies for automating remote monitoring using high priority casualty data).



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Data science approach to autonomous solutions



Thinking of success...

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potential for reliable and successful solutions...
these solutions will be achieved through modeling and
simulation and experienced and appreciated in the real-world

Questions and Discussion



Point of Contact

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